Interventions to improve autobiographical memory specificity in older adults: A strategy to prevent decline in wellbeing

Fiona Leahy

Doctor of Philosophy

Aston University

June 2018

Aston University

Interventions to improve autobiographical memory specificity in older adults: A strategy to prevent decline in wellbeing

Fiona Leahy

Doctor of Philosophy

2018

Thesis Summary

Autobiographical memory (AM) is related to social problem-solving, depression, and independence. However, older adults often have difficulty recalling specific AMs, and this over-general memory (OGM) style is a vulnerability factor for depression. The main aim of this thesis was to examine how useful AM training methods are for reducing OGM in non-depressed older adults. Firstly, the effect of an intervention based on improving flexibility in AM retrieval (MemFlex) was examined in healthy older adults. Next, two AM training interventions were compared in order to investigate the underlying mechanisms that would be most suitable as targets for an older population: Memory Specificity Training (MEST) which targets systematic practice in the executive control process of retrieval, and life review which focuses on enhancing positive memories more related to the concept of self. Finally, the intervention which was found to be most suitable was examined in a clinical sample of older adults with amnestic Mild Cognitive Impairment (aMCI), and acceptability of the intervention was assessed via semi-structured interviews. The results demonstrated that OGM was modifiable in healthy older adults via both MEST and life review, however it was not differentially affected by the MemFlex intervention compared to controls. Life review was considered to be the most appropriate for older adults, however, it did not have any significant quantitative effects in the aMCI sample. Qualitative analysis suggested the element of meaning-making and taking an integrative approach was particularly relevant to them. Narrative coherence should therefore be examined as a potential underlying mechanism that could be further incorporated into the life review programme to enhance its' effectiveness. A consistent finding throughout this body of work was a relationship between change in AM specificity and change in social problem-solving ability, supporting the suggested role of specific retrieval in generating solutions to social problems.

Key words: Healthy ageing, training, depression, social functioning, risk factors

Acknowledgements

Firstly, I would like to thank my supervisor Prof Carol Holland for her continuous support, guidance, and encouragement throughout this PhD, and for always being willing to offer help and reassurance. I am incredibly grateful for having such a good supervisor who has been a pleasure to work with.

Additionally, I am very grateful to Dr Nathan Ridout for making a significant contribution to the research and for offering insightful, helpful comments throughout.

I would like to thank my fiancée David Fisher, my parents (Vivien and Sean), and my other close family and friends for always being there to support , inspire, and encourage me to keep reaching for my goals.

I would also like to express my appreciation to all of my colleagues at Aston University who have provided valuable advice and support.

I would like to say a huge thank you to all the participants who volunteered to take part in my research, in particular the Aston Research Centre for Healthy Ageing participation panel. Without them this research would not have been possible. They have also been a pleasure to work with and have helped make this PhD an enjoyable experience.

Finally, I am thankful to Abbeyfields Research foundation for funding this research, and to Dr Caitlin Hitchcock and her colleagues at the Medical Research Council Cognition and Brain Sciences Unit for sharing their MemFlex protocol and workbook with me.

Contents

List of abbreviations

ACE-III	Addenbrookes Cognitive Examination III
ADL	Activities of Daily Living scale
AD	Alzheimer's Disease
aMCI	Amnestic Mild Cognitive Impairment
AM	Autobiographical memory
AMI	Autobiographical Memory Interview
AMS	Autobiographical memory specificity
AMT	Autobiographical Memory Test
AMT-AI	Autobiographical Memory Test-Alternating Instructions
Positive-pS	Proportion of specific positive memories recalled
ANOVA	Analysis of variance
CaRFAX model	Capture and Rumination, Functional Avoidance & executive function
EM	Episodic memory
FA	Functional Avoidance
FLP	Functional Limitations Profile
fMRI	Functional Magnetic Resonance Imaging
HADS	Hospital Anxiety & Depression Scale
IADL	Instrumental Activities of Daily Living scale
MemFlex	Memory Flexibility training programme
MEST	Memory Specificity Training
MCI	Mild Cognitive Impairment
MEPS	Means End Problem-Solving
Negative-pS	Proportion of specific negative memories recalled

ηp^2	Partial Eta Squared
OGM	Over-general memory
PTSD	Post-traumatic stress disorder
R	Redundancy score on RNG task
RNG	Random Number Generation
SCEPT	Sentence Completion for Events from the Past Tense
SD	Standard deviation
SDM	Self-defining memories
SM	Semantic memory
SPS	Social problem-solving
SS	Scaled score
SWLS	Satisfaction with life scale

List of tables

List of figures

Chapter 1: General introduction

1.1.Overview

Autobiographical memory refers to the recollection of events from one's personal past. The ability to recall specific autobiographical memories is a cognitive skill that is integral to various functions of everyday life, such as social functioning, coherence of the self, mental wellbeing, and guiding future behaviour. However, deterioration in this skill has been associated with increasing age (Holland & Rabbitt, 1990; Piolino, Desgranges, Benali, & Eustache, 2002; Ros, Latorre, & Serrano, 2010), and with depression in younger adults (Williams et al., 2007). Since people are living longer, it is becoming increasingly important to consider functions that extend quality of life in these 'extra' years. Reduced social functioning and depression are associated with cognitive decline and risk of development of dementia. We propose that the role of autobiographical memory in everyday functioning is thus a critical factor in healthy ageing. This thesis presents an examination of interventions to enhance autobiographical memory specificity as a strategy to prevent decline in social and mental wellbeing in older adults, and promote healthy ageing.

According to Conway & Pleydell-Pearce's (2000) self-memory system model, memories are mental constructions drawn from an autobiographical knowledge base with varying levels of specificity in a hierarchical manner. When autobiographical memories (AMs) are drawn from the most specific level, there is a subjective experience of conscious recollection or awareness of a particular event in time and place, with rich sensory-perceptual details. However, at the most general level there is merely an awareness of knowing something about the self, with a lack of sensory details. Thus, specific events are summarised into categories or extended periods (general memories), and general memories are clustered into lifetime periods at the top end of the hierarchy. During autobiographical memory (AM) retrieval, a generative search is performed through this system so that general descriptors used to search the memory system for matching memories become increasingly refined to meet the task demands, i.e. reaching a specific event memory. Thus, earlier descriptors must be inhibited to allow the search to become more refined. Over-general memory, or a difficulty accessing specific memories, occurs when this search process is aborted

early. Over-general memory has been associated with various psychiatric conditions such as depression, post-traumatic stress disorder, and eating disorders (Moore & Zoellner, 2007; Williams et al., 2007; Dalgleish et al., 2003). Increased autobiographical memory specificity has conversely been linked to better mental wellbeing, higher life satisfaction, higher social problem-solving ability and reduction in functional limitations (Latorre et al., 2013; Beaman, Pushkar, Etezadi, Bye, & Conway, 2007; Holland et al., 2017).

In this chapter, relationships between autobiographical memory specificity (AMS) and various everyday functions will be discussed in terms of their relevance in the context of healthy ageing. This chapter will also present evidence for an age-related decline in autobiographical memory (AM) and will review the importance of AMS to older adults' overall wellbeing. An examination of current interventions designed to reduce over-general memory in depression will follow. The overall aim of this research is to develop these interventions into a helpful strategy that can be used with older adults to reduce over-general memory associated with ageing.

1.2. Autobiographical, episodic and semantic memory:

A distinction is often made between episodic memory, referring to the recollection of past events, and semantic memory, referring to the recollection of general knowledge or facts. Autobiographical memory (AM) refers to an individual's personal memories related to the self. Some researchers have referred to AM as the same concept as episodic memory (Nyberg, 1996), since they both involve the detailed recollection of a past event. However, others consider AM to be a sub-component of episodic memory (Piefke, Weiss, Markowitsch, & Fink,2005; Piefke, Weiss, Zilles, Markowitsch, & Fink, 2003; Gilboa, 2004), with the former referring to the recollection of personally experienced events, including those from as long ago as childhood, rather than material encoded in the laboratory. In an fMRI study, Burianova and Grady (2007) found that there were patterns of brain activity common to episodic, autobiographical and semantic aspects of memory, suggesting that there is some overlap between AM, episodic memory (EM) and semantic memory (SM). For example, AM and EMs often contain semantic, factual information such as names of people or places, whilst SM can contain some contextual information such as the emotions attached to a person's name. Another suggestion is that AM can be conceptualised into both episodic and semantic sub-components. For example, Conway & Pleydell-Pearce's (2000) concepts of general memories or lifetime periods may be compared to personal semantic memory, defined as factual knowledge about one's personal past. Conversely, event-

specific knowledge or detailed recollections of personally experienced events including temporo-spatial context is paralleled with definitions of episodic memory.

The neuroimaging evidence provided by Burianova and Grady's (2007) study showed that patterns of activation in the lateral areas of the inferior parietal lobule were shared by both EM and AM, an area which has previously been related to detailed recall as opposed to simply a feeling of familiarity (Wheeler & Buckner, 2004). However, there were also patterns of activation unique to AM. For example, AM retrieval involved activation of the ventromedial PFC which has been related to self-reference (Fossati et al., 2003), and to the insula and areas attached to limbic regions, which are related to emotion. This suggests that a key component of AM that differentiates it from EM is that it involves recall of personally experienced events related to the self and contextual details such as the emotions attached to those memories. Thus, autobiographical memory is not simply a function of cognitive ability, but is a unique, complex, and useful skill.

1.3. Age-related over-general memory (OGM):

A distinction between episodic and semantic memory is supported by a differential pattern of impairment with increasing age, i.e. episodic memory is particularly impaired whilst semantic memory is relatively preserved (Nyberg, 1996; Tulving, 1995). There are similar dissociations in age-related effects on these types of memory as suggested sub-components of AM. Episodic aspects of AM, including details of specific events, are impaired with normal ageing whilst semantic components, similar to general memories of extended or repeated events, are spared (Piolino et al., 2002; Addis, Wong, & Schacter, 2008). There is also evidence supporting this dissociation in the early stages of dementia and mild cognitive impairment (Berna, Schonknecht, Seidl, Toro, & Schroder, 2012; Murphy, Troyer, Levine, & Moscovitch, 2008).

This distinction is in line with the hierarchical account of AM described above (Conway & Pleydell-Pearce, 2000) since older adults have been shown to have a particular difficulty accessing the most specific memories, i.e. those containing more episodic details, and tend to retrieve more general memories containing semantic information in the middle layer, compared to younger adults (Holland & Rabbitt, 1990; Piolino et al., 2002; Ros et al., 2010). For example, they may recall general memories, e.g. "We always used to go on holiday to Blackpool", rather than recalling memories of one particular event, e.g. "I remember feeling excited the first time I went to the top of Blackpool tower". This over-general AM retrieval style (OGM) is supported by other

findings of age-related cognitive changes, such as the proposed shift from recollection to familiarity which has previously been reported in ageing research (Jennings & Jacoby, 1997). Retrieving detailed specific memories allows the conscious re-experiencing of a recollected event, including its sensory-perceptual features, whilst general semantic memories may only provide a sense of familiarity or a feeling of knowing information about the self.

Furthermore, in a review, Craik & Rose (2012) refer to evidence that older adults may have a more general style of processing (Craik & Simon, 1980), encoding similar repeated events in a similar way, whilst younger adults may be able to differentiate and process specific information at a deeper level during encoding (Morcom, Good, Frackowiak, & Rugg, 2003), thus allowing better subsequent retrieval. They suggest that older adults are less able to self-initiate the process of encoding context specific details automatically, but that environmental support can help reduce this top-down impairment by enhancing bottom-up external stimulation, such as providing cues to the original context of when/where the memory was encoded (Craik & Schloerscheidt, 2011). Although Craik and Rose (2012) mainly refer to the encoding stage of memory in their review, their suggestions are relevant since better encoding is likely to consequently allow better subsequent retrieval. Their suggestion that environmental support can help with this, implies that training methods may be useful in reducing this general style of processing.

Executive function:

A decline in executive functioning is also a common age-related effect, and this is proposed as a mediator of OGM in older adults. There is evidence to support the suggestion that the generative retrieval process of moving from general to specific memories in older adults is impaired due to reduced executive functioning ability. For example, neuroimaging findings display the role of frontal-executive neural regions in AM retrieval and their age-related decline (Martinelli et al., 2013). Piolino et al (2010) also provide evidence for an age-related deficit in AMS which was primarily mediated by executive functioning performance. In particular, deficits to the updating and inhibition aspects of working memory appeared to be critical to AM performance (Piolino et al., 2010). This indicates the role of updating in the monitoring and modification of information relating to the search criteria, and inhibition in the filtering out of general or distracting information during memory retrieval. The importance of the updating aspect has further been emphasised by Holland, Ridout, Walford, & Geraghty (2012), who found that updating ability predicted AM specificity to neutral cues in an

older adult group. Ros, Latorre and Serrano (2010) also found that older adults produced more OGMs than younger adults, and that working memory executive processes had a strong relationship with OGM. These findings therefore support that age-related decline in executive function may account for reduced specificity in older adults. Thus, executive function may represent a key target when considering training methods to improve autobiographical memory specificity in older adults. In Chapter 2 an intervention which aims to reduce this automaticity towards a general style of autobiographical memory retrieval is explored, by targeting the executive functions which underlie cognitive flexibility (see Section 1.9. Cognitive flexibility [MemFlex] programme).

1.4. Protective effects on cognition:

Rather than just focussing on basic underlying cognitive mechanisms such as working memory or executive function, Hertzog, Kramer, Wilson, & Lindenberger (2008) highlight the need for cognitive ageing research to progress our understanding of the association between cognitive functions and the way they are actually used for everyday life activities which are central to wellbeing. We propose that autobiographical memory specificity (AMS) is one such functional type of cognitive ability that may be an important contributing factor to wellbeing in older adults since it is related to everyday functions, as will be discussed in Section 1.5.

Life expectancy at older ages has reached its highest ever level (Public Health England, 2016), but there has also been a rise in the number of years people live with ill health (Office for National Statistics, 2016). Therefore, factors that ensure quality of life such as maintaining mental health, enriching social engagement and prolonging independence, have become increasingly important within the field of cognitive ageing. There is increasing evidence to support the view that maintaining a socially, physically and intellectually engaged lifestyle has protective effects on cognition. For example, having a large social network was found to reduce the manifestation of cognitive impairment, despite the presence of Alzheimer's disease pathology (Bennett, Schneider, Tang, Arnold, & Wilson, 2006). AM is integral to social problem-solving (Beaman et al., 2007) and thus maintenance of social relationships with others. These processes contribute to preserved wellbeing and prolonged independence with increasing age by enabling individuals to maintain rewarding social relationships and engage in social and intellectually stimulating activities, which consequently produce cognitive enrichment effects (Hertzog et al., 2008). The current research focusses on

strategies that aim to improve or maintain this aspect of memory, in order to help prevent social and cognitive decline in older adults.

The concept of 'reserve' refers to the theory that some aspects of brain structure or function have a buffer effect against cognitive decline (Richards & Deary, 2005), and thus is important to successful ageing. The variability of cognitive change with increasing age, together with findings of maintained cognitive function in some individuals who possess pathological indicators of Alzheimer's disease whilst not in others, prompts us to consider what predicts this variability (Katzman et al., 1988; Crystal et al., 1993; Riley, Snowdon, & Markesbery, 2002; Knopman et al., 2003). Richards and Deary (2005) identify reserve as something that accounts for variability in cognitive function in later life, greater than that predicted by childhood levels of mental ability. It is proposed that a greater reserve results in less functional impairment or clinical manifestation of diseases which affect cognition (Richards and Deary, 2005). Exposure to enriched environments may indirectly represent a type of reserve by promoting the extension of neural networks. For example, animal studies have shown that enriched environments and engagement in learning-memory tasks modulated increased hippocampal neurogenesis (Kempermann, Gast, & Gage, 2002; Kempermann, Kuhn, & Gage, 1997). Furthermore, higher levels of complex mental activity across the lifespan in humans have been associated with lower rates of hippocampal atrophy (Valenzuela, Brodaty, Wen, Chen, & Sachdev, 2009). This has implications that modifying our environment may have a buffer effect on cognitive function.

A wealth of research has explored the relationship between environmental lifestyle factors and cognitive change both in normal ageing, and impairment associated with dementia. Evidence from longitudinal studies suggests there are beneficial effects of physical, social, and mental activity on enhancing cognition in older adults without significant impairment, on reducing the rate of normal cognitive decline, and on delaying cognitive impairment associated with dementia (Bennett et al., 2006; Wilson, Scherr, Schneider, Tang, & Bennett, 2007; Hertzog et al, 2008; Wang et al., 2013). Factors such as education, extent of social networks, physical fitness, and complexity of both occupational and leisure activities, have all been reported to have a beneficial influence on age-related cognitive change (Kramer, Bherer, Colcombe, Dong, & Greenough, 2004; Wang et al., 2013; Schooler, Mulatu, & Oates, 1999; Lovden, Ghisletta, & Lindenberger, 2005; Hultsch, Hertzog, Small, & Dixon, 1999). Thus, it appears that enriched environments that involve intellectual stimulation, such as

participation in cognitively demanding tasks, may contribute to cognitive reserve and are associated with higher cognitive ability in older adults (Kramer, Bherer, Colcombe, Dong, & Greenough, 2004; Wang et al., 2013; Schooler & Mulatu, 2001; Hertzog et al., 2008; Lövden, Ghisletta, & Lindenberger, 2005; Hultsch, Hertzog, Small, & Dixon, 1999). An engaged lifestyle may therefore buffer against age-related cognitive changes (Small, Dixon, McArdle, & Grimm, 2012). In Hertzog et al's (2008) review of this research, the author concluded that engaging in an intellectually active lifestyle that involves cognitive effort promotes successful cognitive ageing. This research provides an optimistic view of how the amount people engage or refrain from social, mental, physical activity can influence cognitive function in later life (Hertzog et al., 2008). The importance of AM to social functioning, thus allowing people to maintain an engaged lifestyle, is therefore highly relevant in healthy ageing research.

There are two main hypotheses that may explain the relationship between lifestyle activity and cognitive function. Firstly, that environmental stimulation may directly enhance the efficiency, or plasticity, of neural processes (Stern, 2002). Secondly, increased activity likely involves engagement with other people and improved emotional states, which may indirectly have a positive effect on cognition by lowering stress, reducing inflammation by affecting the immune system, and by improving coping with challenging life events (Kiecolt-Glaser et al., 2003; Seeman, Lusignolo, Albert, & Berkman, 2001; Ellwardt et al., 2013). Having a strong social support network and engaging in social activities has been found to improve cognitive performance in older adults without dementia (Lovden et al., 2005), and to help slow the progression of cognitive impairment associated with dementia (Wilson et al., 2007; Bennett et al., 2006). Loneliness has been associated with increased cognitive decline (Baumeister, Twenge, & Nuss, 2002; Cacioppo & Hawkley, 2009; Tilvus et al., 2004; Wilson et al., 2007), and elevated cortisol levels (Cacioppo et al., 2000). Elwardt, Aartsen, Deeg and Steverink (2013) propose that the relationship between social activity and maintained cognitive function is mediated by increased emotional support and reduced loneliness. Thus, older adults with stronger social networks have more support and may cope with stress better, subsequently having a positive influence on cognitive function. Therefore, as Bennett et al (2006) suggested, building a reserve of the functional aspects of cognition, such as those that help maintain social networks, may protect against impairment. Since AM has various social uses and is directly linked to solving social problems, and therefore maintenance of relationships, we propose that AM may be a suitable target for protection against impairment.

In addition, Armstrong et al (2015) emphasise the need to understand how different protective factors work in combination to have a positive effect on cognition, rather than looking at individual factors. They found that there was a cumulative effect of social deficits, such as loneliness and isolation, on cognition. Thus, an increased number of protective factors results in greater protection from decline in later life. Autobiographical memory (AM) is a functional cognitive ability which has links to multiple factors that contribute to the ability to remain actively engaged. For example, AM is not only linked to social functioning but to functional limitations, and to depression, which has also been proposed as a risk factor for cognitive impairment (Chung et al., 2015). Therefore, maintaining AM may contribute to one's cognitive reserve via these factors. A review of the functional uses of AM follows.

1.5. Functions of autobiographical memory:

The way autobiographical memory (AM) is used in everyday life is discussed in a paper by Bluck (2003). The focus of the discussion is about why and how people remember events from their past. This approach ultimately helps us to understand how AM is used in everyday life to serve social and emotional functions, and therefore why it is important to enhance or maintain AMs as we age. In Bluck's (2003) paper the functions of AM are referred to under three main categories: self, social and directive (Bluck, 2003). The 'self' function refers to the way AM may be used to provide continuity to a person's sense of self, which facilitates a coherent identity over time (Barclay, 1996). 'Social' uses of AM include developing intimacy with others, teaching or informing others through illustration, and eliciting or providing empathy (Alea & Bluck, 2003). Lastly, the 'directive' function refers to the way AM may be used to plan or predict the future, for example, memories of our past may be used to shape the attitudes and opinions that guide our behaviour (Cohen, 1989). There is evidence from various sources that the use of AM in these three domains help contribute to an individual's overall wellbeing, as discussed in the following sections.

Social:

There is an interpersonal nature of AM as AM recollection often occurs in social contexts, for example, telling someone about an event they were not present at, or re-constructing details from an event with someone else who was also present at the event (Alea & Bluck, 2003). The function of AM in social contexts may be considered to be fundamental from a developmental perspective. Recounting and sharing memories and using another person's representation of an experience can help us to re-instate

that experience to ourselves, and as a result, the memory forms part of the AM system (Nelson, 1993). For example, an AM system is developed in children by learning to how to talk about and thus formulate a narrative of personal memories (Nelson, 1993). This overlaps with the function of self because social interaction facilitates building our own narrative of past events, which contributes to coherence of sense of self. AM is also integral to social problem-solving which overlaps with the directive function of AM. Thus, some consider the social functions of AM to develop and maintain relationships to be their most important use (Nelson, 1993).

Alea and Bluck (2003) present a model which highlights three main uses of AM in a social context; to develop intimacy, teach or inform others, and to elicit empathy. Their model focusses exclusively on the process of sharing AMs with others. This provides a useful basis for understanding the importance of AM from an ecological perspective, as it focuses on their actual use in everyday life. The model accounts for both what AMs are used for, and the way they are used to achieve the desired outcome, i.e. either adaptively or maladaptively. In order to do this Alea and Bluck (2003) developed a model to consider variables that may influence how adaptively the memory is used, or how successfully the social function is fulfilled.

According to their model of the social uses of AM (Alea & Bluck, 2003), among the variables affecting adaptability of AM for social purposes are: memory characteristics, speaker and listener characteristics, the memory sharing process, and the relationship between speaker and listener. For example, memory characteristics such as personally meaningful details and emotions are remembered more vividly, e.g. flashbulb memories (Brown & Kulik, 1977) and are recognised as important factors affecting the social functions of AM. More detailed and emotionally rich memories may aid the achievement of interpersonal goals because they communicate the emotional meaning as well as the informational content (Pillemer, 1992), thus making them more credible for teaching others, developing intimacy, or for the function of empathy. This suggests that specific, detailed memories may be more useful for social purposes than general AMs.

All of these variables are presented in Alea and Bluck's (2003) model as nested within the wider lifespan context. Thus, the model indicates that a person's age and life context can influence the way AMs are used for social functions. There is a shift towards emotional goals away from knowledge-based goals in later life, as the socioemotional selectivity theory posits (Carstensen, Isaacowitz, & Charles, 1999), thus people's motives and priorities change over time. This is supported by evidence

for the positivity effect in older adults, whereby attentional and memory processes are biased towards positive material over negative material (Mather & Knight, 2005) possibly with the purpose of fulfilling more emotionally meaningful goals. If goals are more emotionally based, this may also influence social relationships, as older adults may choose to spend more time in networks that maximise positive emotional experiences (Alea & Bluck, 2003). Therefore, the social function of AMs to develop intimacy may be prioritised in later life (Alea & Bluck, 2003). The authors further suggest that the social function to teach or inform others becomes more relevant with age, as memories from the past are used to direct future generations (Erikson, 1980). The function of empathy may also be used more often to adapt to losses in later life (Neugarten, 1979).

The social uses of AM become increasingly important with age, as maintaining social relationships and staying socially active enables greater participation in mentally stimulating activities, which consequently has protective effects on cognition (Hertzog et al., 2008). As highlighted earlier in Section 1.4, having a large social network has been found to protect against cognitive impairment (Bennett et al., 2006). Furthermore, Ellwardt et al (2013) found that support from close emotional relationships, rather than instrumental support, was related to reduction of loneliness and protection of cognitive function in older adults, suggesting quality rather than quantity of social relationships is important in later life. This is in line with findings that level of perceived support is a better predictor of wellbeing than received support (Helgeson, 1993). Social support can also improve coping with stressful emotional situations (Ellwardt et al, 2013), potentially reducing the impact of stress on loss of hippocampal cells in the brain (Sapolsky, Krey, & McEwen, 1986). Thus, preserving autobiographical memory so that it can be used for the social functions proposed by Alea and Bluck (2003) is vital. Throughout this thesis the relationship between AM retrieval and social functioning was examined based on the prediction that improvement in AMS would be related to improvement in social functioning.

Directive:

The directive function refers to the way autobiographical memories (AMs) may be used to plan or predict the future. This incorporates the use of the past to shape the attitudes and opinions that guide our behaviour (Cohen, 1989). It has links to the social function as we use the past to construct models that help us understand and predict other people's future behaviour as well (Robinson & Swanson, 1990). From an evolutionary perspective, humans have a basic need to both understand the present (by framing it

in the past), and to use this understanding to predict the future and plan our actions (Nelson, 2003).

Memories of past events provide analogues that are useful for generating solutions to current social problems (Goddard, Dritschel, & Burton, 1996). Beaman et al (2007) demonstrated a relationship between autobiographical memory specificity (AMS) and social problem-solving ability in older adults, as measured by the Means End Problem-Solving Procedure (MEPS; Platt & Spivack, 1975). It is hypothesised that this relationship is due to age-related cognitive deficits that affect the hierarchical process of specific AM retrieval as described in Section 1.3. Goddard, Dritschel & Burton (1998) support this hypothesis with the finding that cognitive load significantly reduced specific memory retrieval and the generation of alternative solutions to social problems in healthy subjects. Beaman et al (2007) found that cognitive ability predicted AM specificity, but did not predict performance on the MEPS task directly. AM specificity, however, did predict social problem-solving ability in both young and older adults when cognitive ability was controlled for. Therefore, it appeared that social problem-solving was related to AMS, rather than a general cognitive factor. Social problem-solving is identified as having particular importance to older adults' wellbeing because it may prevent the impact of negative social interactions. This is important because negative interactions such as criticism have been shown to have more of a detrimental effect on health in later life than a lack of positive interactions (Newsom, Nishishiba, Morgan, & Rook, 2003). Thus, interventions that target social problem-solving in later life to improve wellbeing are warranted, and improving AMS may be one such approach that can contribute to this.

More recently, there has been further evidence to support the hypothesis that similar episodic retrieval processes are employed for tasks that involve remembering the past, to those which involve imagining the future or hypothetical scenarios. For example, older adults report fewer internal or episodic details and more external, semantic details of both past and future or imagined events (Addis, Wong, & Schacter, 2008). This implies that the same impaired episodic memory processes that underlie the retrieval of past events, also underlie the construction of imagined future events. This is in line with the constructive episodic simulation hypothesis which states that details from the past can be retrieved flexibly and combined into a simulation of future events (Schacter & Addis, 2007, 2009). In support of this, Sheldon, McAndrews, & Moscovitch (2011) found evidence of poorer social problem-solving in populations that have deficits in medial temporal episodic memory, such as older adults, and in populations

with hippocampal damage. These populations exhibited a reduction in number of effective solutions on the MEPS, as well as fewer episodic details in the solutions they did generate.

Furthermore, Madore and Schacter (2014) found that an episodic induction (brief training in recalling the details of past events with enhanced specificity) resulted in not only increased number of specific internal (episodic-related) details on remembered past events and imagined future events, but also on number of solutions generated and improved performance on the MEPS task. The effect was found for both young and old age groups, therefore implying that episodic induction can benefit older adults' AM retrieval as well as younger adults. This supports the proposal that improving AMS should also facilitate social problem-solving ability. One of the aims throughout this thesis is to assess whether interventions that aim to improve AM retrieval can also have a related positive effect on social problem-solving ability.

Sheldon, McAndrews, & Moscovitch (2015) further examined how episodic processes are involved, and by what mechanisms AMs are translated into the generation of solutions on a task such as the MEPS. They did this by examining problem-solving ability in a group of participants with a condition named amnestic Mild Cognitive Impairment (aMCI), which is characterized by a significant episodic memory impairment (lower than that expected by age) but an absence of dementia, compared to healthy controls. Sheldon et al (2015) outlines the neural processes underlying the episodic processes involved in ill-defined problem-solving. Ill-defined problem-solving refers to problems that are open-ended, or that do not have a set algorithm or definite solution. Social problems are a type of ill-defined problem in this manner, as they are more likely to require flexible thinking and the simulation of possible solutions in order to solve them (Sheldon et al., 2011). This type of problem-solving would therefore require episodic retrieval processes rather than semantic memory which is more useful for well-defined problems with a set solution, such as mathematical problems. Sheldon et al (2015) points to the involvement of the medial temporal lobes, an area that has been associated with aMCI (Masdeu, Zubieta, & Arbizu, 2005) and the hippocampus in episodic remembering. It is thought these regions underlie the conscious re-experience of past events when they are recalled via the binding together of co-occurring details (Cipolotti and Moscovitch, 2005; Moscovitch, 1995; Nadel and Moscovitch, 1997, 2001). Sheldon et al (2015) found that the aMCI group retrieved a fewer number of episodic details (i.e. internal details about an event that are specific to its temporal and spatial context) in their AMs, and this was related to reduced ability to

simulate solutions in an ill-defined problem-solving task. This supports the proposition that medial-temporal episodic memory processes may be involved in recombining past events to simulate solutions and predict future events, and that these processes contribute to ill-defined problem-solving.

The relationship between AM and ill-defined problem-solving is important because it suggests that strategies that enhance or maintain AM retrieval could not only enhance social problem-solving, but could also enhance ability to generate solutions to other types of ill-defined problems that occur in everyday life, such as financial management or medical decision making. Being able to solve these types of problems more effectively may help maintain independence in individuals living with episodic memory deficits, such as people with amnestic Mild Cognitive Impairment (aMCI) (Sheldon et al., 2015), as will be discussed in Section 1.6. Further to this, there is similar evidence for an association between medial-temporal episodic processes and ill-defined problem-solving in healthy older adults (Vandermorris, Sheldon, Winocur, & Moscovitch, 2013), thus suggesting wider implications for the role of AM in independence in older adults without cognitive impairment, for example those with mobility issues or physical disabilities. In support of the relationship between AM and functional independence, Holland et al (2017) found that AM in older adults who moved into a supportive living environment predicted reduction in functional limitations. Thus, functional independence is one of the factors that will be examined in this thesis in relation to AMS in older adults.

Self:

The ‘self’ function refers to the way AM may be used to provide continuity to a person’s sense of self, which facilitates a coherent identity over time (Barclay, 1996). This concept complements a psychodynamic perspective because knowledge of oneself in the past is used to evaluate or enhance oneself in the present. Thus, earlier experiences or events have psychological and emotional importance to the self (Pillemer, 1992). The philosopher, William James’ (1890/1950) comment that if a person’s memories were erased they would essentially be a different person, intimates that AMs are an essential aspect of the self. One mechanism of the ‘self’ function is the regulation of emotion. Bluck (2003) refers to Pasupathi’s (2003) finding that the emotional intensity of memories is often different when we retell the event to when it was experienced. It can be down-regulated or up-regulated to enhance the current self, e.g. down-regulating negative emotions such as feeling scared to enhance the self as being courageous. This has implications for the role of AM in mood state as retrieving

specific positive memories can regulate or lift current mood. Thus, recalling specific memories from the past is likely to influence our current mood state as the emotions attached to the memories are re-experienced. We have seen that individuals with depression have difficulty with this (Williams & Broadbent, 1986) and tend to have a negative view of themselves, which may be upheld by a lack of retrieval of positive memories to contest this view.

The contribution of AM to sense of self has been examined in a group of Schizophrenia patients (Ricarte, Hernandez-Viadel, Latorre, & Ros, 2012). A disturbed sense of self is common in schizophrenia and this may be attributed to reduced specificity of AM retrieval and lack of autonoetic awareness (Blairy et al., 2008; Danion, Rizzo, & Bruant, 1999; Huron & Danion, 2002; Riutort, Cuervo, Danion, Peretti, & Salamé, 2003). As these are also factors associated with Schizophrenia, the relationships between these variables can be examined more closely in this patient group. Autonoetic awareness relates to the re-experiencing of an event when it is recalled (Wheeler, Stuss, & Tulving, 1997), and it has previously been associated with AMS (Danion et al., 2005; Neumann, Blairy, Lecompte, & Philippot,, 2007). For example, in Conway and Pleydell-Pearce's (2000) self-memory system model, when AMs are drawn from the most specific level there is a subjective experience of conscious recollection, or awareness of that event with sensory-perceptual details attached. However, at the most general or abstract level there is only an awareness of knowing something about the self, in the absence of sensory details. Ricarte et al (2012) propose that since details of past events are more difficult to access, and conscious awareness of these events is reduced in schizophrenia, it is more difficult to utilise past experiences to enhance a sense of self. Ricarte et al (2012) tested the effectiveness of a training programme on AM specificity, degree of conscious awareness, and depression symptoms of schizophrenic patients. The training was designed to focus on self-defining memories (SDMs), which are memories of events or experiences that have particular value to the self (Martinelli, Anssens, Sperduti, & Piolino, 2013). They found patients in the training group had significantly improved AMS, enhanced levels of consciousness of memories, and reduced depression scores. The authors propose that the finding of a positive effect on mood where other interventions had failed was due to the particular use of SDMs which were important to identity, thus highlighting the importance of identity on emotional recovery. This study emphasises the importance of specific AM retrieval to sense of identity and maintenance of mood, thus providing support for interventions that aim to increase AM specificity.

Since AM is important to preserving a sense of self, this leads us to consider what effects a deterioration of AM has on identity. It is proposed that AM ability may be important to life satisfaction and wellbeing via its use for the integration of past memories to provide a meaningful narrative by which to understand and strengthen our current selves (Fivush, Bohanek, & Duke, 2008). There is also evidence that a strong sense of social identity can protect wellbeing, e.g. strengthened social identity within a minority group can protect against the negative impact of discrimination (Branscombe, Schmitt, & Harvey, 1999). In the context of ageing, Jetten, Haslam, Pugliese, Tonks, & Haslam (2010) looked at the relationship between cognitive deterioration and decreased wellbeing in dementia patients. They compared life satisfaction scores, self-rated personal and social identity strength, as measured on a 5 point scale in response to items relating to identity taken from previous research (Haslam et al, 2008; Iyer, Jetten, Tsivrikos, Postmes, & Haslam, 2009), and autobiographical memory scores on the Autobiographical interview (AMI) in dementia groups with varying levels of severity. The AMI gives a total score of both personal semantic (e.g. names of school friends) and specific autobiographical components (e.g. a particular incident at school) of memories recalled by participants from three life periods. They found that increasing severity correlated with AM loss, and that AM loss was associated with reduction in both personal and social identity. Personal identity loss also mediated the relationship between AM loss and decreased wellbeing, rather than general cognitive ability. This highlights the importance of AM in building identity when cognitive resources have deteriorated, and supports the theory that identity is important to wellbeing. Therefore, AM is not simply a proxy for general cognitive function, but rather is a unique aspect of cognition critical to sense of self. This supports the suggestion that AM is differentiated from other types of memory due to its focus on self-reference and personal information (Burianova and Grady, 2007), as discussed in Section 1.2. Therefore, the ability to retrieve these types of memories may be related to wellbeing because it enables the construction of a sense of identity. Findings of a ‘reminiscence bump’, whereby memories of early adulthood are preferentially selected by older adults (Franklin & Holding,1977) supports this theory, as memories from this period are preserved due to their importance in the formation of identity (Bernsten & Rubin, 2002; Staudinger, 2001). Jetten et al (2010) suggests that programmes aimed at improving wellbeing in dementia patients should focus on strategies that strengthen identity. Autobiographical memory retrieval is therefore a suitable target for this.

1.6. Amnestic Mild cognitive impairment (aMCI) and OGM:

Autobiographical memory specificity is impaired in older adults with amnestic mild cognitive impairment (aMCI) to a greater extent compared to healthy older adults. Amnestic type MCI is characterised by deficits in memory that are above that expected for a person's age and educational level, and is considered to be an intermediate stage, or risk stage, between normal ageing and dementia. However, a large proportion of people with MCI return to a non-MCI diagnosis a year later (for review see Apostolo et al, 2016). Thus, preventive interventions to maintain cognitive and mental wellbeing are particularly pertinent in this group.

There is a decline in AMS in aMCI compared to healthy ageing, and from aMCI to Alzheimer's disease. For example, Murphy et al (2008) found that patients with aMCI retrieved fewer episodic, event specific details and more semantic details compared to a group of normal older adults. Therefore, the effect of age on the semantic/ episodic dissociation is further magnified in aMCI, whilst in Alzheimer's Disease (AD) both episodic and semantic AMs are significantly impaired (Hou, Miller, & Kramer, 2005; Ivanoiu, Cooper, Shanks, & Venneri, 2006). Donix et al (2010) also highlighted the significant impairment to AM specificity in aMCI compared to healthy older adults, whilst there were only subtle group differences in episodic memory as measured by the California Verbal Learning Task. The authors therefore highlight the potential use of Autobiographical Memory Task (AMT) performance in diagnostic procedures, although much further work would be needed to determine suitable ranges. These findings are in line with the multiple trace theory (Nadel & Moscovitch, 1997) which posits that there is more impairment to episodic than semantic memory due to hippocampal damage in AD. Thus, semantic details remain accessible in the early stages, whilst episodic details rely on the hippocampus and thus are degraded. Martinelli, et al (2013) further provide support in an fMRI study for this theory by confirming that episodic AM is specifically dependent on the hippocampus. Murphy et al (2008) suggests that semantic AM later becomes impaired when damage is extended to the lateral temporal cortex.

In a position statement, Apostolo et al (2016) highlight social participation and depression as important psycho-social factors involved in the development of MCI. Evidence suggests that low social participation is associated with cognitive decline (Bennett et al., 2006) and the quality of social relationships appears to be more important than size (Amieva et al., 2010). Donix et al (2010) further highlight the significance of AM for social problem-solving in aMCI patients since aMCI patients already have problems with social interaction-related daily routines (Rojas, Leis,

Roman, Allegri, & Demey, 2014). Donix et al (2010) found significant deficits in AM specificity in patients with aMCI and early AD and suggest this deficit may contribute to social functioning decline in these groups. They further propose that AM specificity may even be a better predictor of deficit in social problem-solving than other cognitive deficits. They support this with evidence from Beaman et al's (2007) study that cognitive function alone did not predict social problem-solving in healthy older adults, although it did predict AMS, which subsequently predicted social problem-solving, suggesting that AM acts as a mediator. We propose that AM is a vital target for preventive interventions in aMCI patients who are at high risk of progression to AD. The association between autobiographical memory and the psycho-social risk factors for the development of MCI (e.g. social functioning, depression) will be considered in Chapter 4.

Interventions to facilitate social functioning may therefore be extremely valuable in aMCI. In support of this, more engagement in social activities at the mild stage of impairment has previously been related to a reduced risk of progression from mild to severe cognitive impairment (Hughes, Flatt, Fu, Chang & Ganguli, 2013). Supportive environments may facilitate active engagement in sociable activities, whilst also helping to maintain independence (Apostolo et al, 2016). Social functioning is also interrelated to another risk factor for MCI, depression. Having supportive social relationships helps people to deal with stress and maintain their mental wellbeing. Depression is commonly associated with cognitive impairment, with up to 32% of people with dementia, and 20% of people with MCI experiencing depressive symptoms (Lyketsos et al., 2002), thus impacting their quality of life. Depression is thought to be one of the risk factors for MCI (Chung et al., 2015), and over-generalisation of AM, which has already deteriorated in MCI, is thought to be a vulnerability factor for depression (Anderson, Goddard, & Powell, 2010). Since AM performance has implications for mental health and social functioning, it may represent an important cognitive skill to preserve or rehabilitate in people with MCI.

AM is also related to wellbeing in people with MCI due to its role in maintaining a sense of self. Many studies have found that deficits in AM are related to weakened sense of self in AD (Addis & Tippet, 2004; Fargeau et al., 2010) and that this has a negative impact on wellbeing (Jetten et al., 2010). Self-defining memories (SDMs) contribute to a life story and a sense of identity. Martinelli, et al. (2013) found that AD patients had a deficit in recalling detailed SDMs compared to both healthy young and older adults, whilst SDMs in healthy older adults were relatively preserved. Furthermore, measures

of self-concept were correlated with AM in young and older subjects, but not in AD patients. They concluded that preserved SDMs in healthy older adults facilitated a positive sense of self, compared to impaired AM and reduced self-concept in AD patients. Matinelli et al (2013) propose memory training methods that focus on positive memories to enhance positive sense of self may be valuable for people with dementia. Since the deficits associated with AD are so closely linked to aMCI, and sense of self is important to mental wellbeing, in this thesis the impact of an intervention that focusses on specific positive memory recall in a sample of patients with aMCI was investigated (see Chapter 4).

El Haj, Antoine and Kapogiannis (2015) investigated this topic further by comparing memory for past events and imagining future events, and looked at how each may contribute to sense of self in AD by focussing on SDMs. They found similarities between past and future events in AD patients in terms of themes, contextual information, consciousness states, and amount of SDMs produced. AD patients also produced fewer SDMs than controls, and showed greater impairment to autonoetic consciousness during both past and future thinking. This further supports the constructive episodic simulation hypothesis, and suggests that the deficit in underlying episodic processes affected by AD leads to difficulty projecting oneself into future as well as the past, which could potentially contribute to lack of continuity and weakened sense of self. Thus, improving ability to retrieve specific contextual details of AMs from the past, allowing autonoetic consciousness or re-experiencing the event, may provide access to a larger pool of information for future simulations to be drawn from (El Haj et al., 2015). This ability is important for guiding future behaviour, preventing functional decline, and for social problem-solving. It is therefore particularly important to maintain this type of memory in order to aid social problem-solving in a high risk group such as aMCI whilst, there is some preservation of these resources compared to in AD.

1.7. Over-general memory associated with depression:

Autobiographical memory (AM) is strongly linked to mood and emotional wellbeing. Since Williams & Broadbent's (1986) discovery that suicide patients recalled memories that were general rather than specific it has been well established that depressed individuals (Brewin, Reynolds, & Tata, 1999; Brittlebank, Scott, Williams, & Ferrier, 1993; Kuyken & Dalgleish, 1995; Wessel, Meeren, Peeters, Arntz, & Merckelbach, 2001), and other clinical groups such as people with post-traumatic stress disorder (PTSD; McNally, Litz, Prassas, Shin, & Weathers, 1994) or people with eating

disorders (Dalgleish et al., 2003) have reduced autobiographical memory specificity (AMS). As discussed earlier, healthy non-depressed older adults also have reduced AMS and tend to recall general memories instead. Furthermore, depressed older adults have less specific AM than non-depressed older adults (Ricarte et al., 2011; Gidron & Alon, 2007; Birch & Davidson, 2007). Therefore, there is extensive evidence that this over-general autobiographical retrieval style is a phenomenon of both depression and ageing.

Research further suggests that this difficulty in retrieving the details of past specific events, and a tendency to recall OGMs instead is not simply a cognitive state associated with psychopathology, but that it has a central role in the development, maintenance and recovery of these clinical conditions. For example, over-generality is an enduring characteristic of depression persisting after recovery (Anderson et al., 2010; Brittlebank et al., 1993; Raes et al., 2006). Reduced specificity has been related to subclinical depression (Ramponi, Barnard, & Nimmo-Smith, 2004). AMS has also been found to predict increased emotional reactivity to stressful life events in non-clinical groups (Bryant, Sutherland, & Guthrie, 2007; Gibbs & Rude, 2004; Mackinger, Loschin, & Leibetseder, 2000; Minnen, Wessel, Verhaak, & Smeenk, 2005), and mediates the relationship between chronic daily hassles and depression (Anderson, et al., 2010). Furthermore, reduced specificity of AM has been found to have stronger predictive value for the course of depression than strength of the initial symptoms (Kleim & Ehlers, 2008; Neshat Doost et al., 2013). Taken together, these findings support that OGM is a stable marker and is considered to be a vulnerability factor for depression. In addition, Latorre et al (2013) found that AMS was higher in a non-clinical sample of older adults with low depression scores compared to those with high depression scores, and AMS was positively related to life satisfaction. Ricarte et al (2011) also found a relationship between life satisfaction and specific AM recall in non-depressed older adults. Therefore, the mechanism of higher specific AM is considered to be protective against depression in healthy older participants, implying AMS is a potential tool for healthy ageing interventions that aim to prevent decline in mental wellbeing.

Theories and mechanisms underlying the link between depression and AMS:

Some of the everyday functions of AM may explain the link between reduced specificity of AM and depression. For example, the use of AM to aid imagination of specific events in the future may be hindered (Williams et al., 1996) leading to hopelessness; the link between OGM and reduced social problem-solving ability (Beaman et al., 2007) may

result in more negative social encounters; reduced AMS may prevent access to negative memories, limiting exposure to the attached negative emotions which can actually have long term benefits to wellbeing (Littrell, 1998; Pennebaker & Seagal, 1999). Depression may also be related to reduced AMS via its reciprocal relationship with ruminative thinking, whereby a difficulty accessing specific memories reinforces rumination on negative thoughts, and vice versa (Raes et al., 2006; Ramponi, et al., 2004; Watkins & Teasdale, 2001, 2004; Watkins, Teasdale, & Williams, 2000). Thus, interventions that aim to improve AMS are advocated in order to lessen the impact of these mediating factors on the exacerbation of symptoms, and to help prevent future depressive symptoms. One of the aims of the current thesis is to explore the use of interventions to help prevent depression, via reduction of OGM in older adults.

Various theories have been developed to explain the relationship between depression and OGM. For example, according to the functional avoidance hypothesis, the generative search for AMs is aborted early in depression as a mechanism of affect regulation to avoid painful emotional material (Williams, Stiles, & Shapiro, 1999; Williams et al., 2007). In other words, since elaborating on specific negative material may cause negative emotional arousal, the process is avoided and retrieval remains at the general level. There is evidence that this process becomes maladaptive since depressed participants also show OGM to positive material (Williams et al., 2007). Others have found that young adults with depression produced more OGMs in response to positive, than to negative cues (Dalgleish et al., 2001; Park, Goodyer, & Teasdale, 2002; Williams & Scott, 1988). This theory is supported by findings that OGM is more common in people with a history of trauma, and is related to avoidance of memories of the trauma (Kuyken & Brewin, 1995).

Conway and Pleydell Pearce's (2000) hierarchical account of AM has also been elaborated to develop the CaR-FA-X model (Williams, 2006; Sumner et al., 2012). This model outlines capture and rumination on general themes, functional avoidance of painful emotional material, and impaired executive control as the three main mechanisms underlying the relationship between depression and reduced AMS. In a series of studies Dalgleish et al (2007) present significant support for the role of impaired executive control in OGM associated with clinical disorders. For example, performance on the AMT which measures ability to recall specific AMs, was significantly related to performance on executive control measures, whilst controlling for depression. Furthermore, executive control performance mediated a relationship between depression ratings and AMS. In an examination of the components of the

CaR-FA-X model in younger adults, Sumner (2014) concluded that there was robust support for a relationship between over-general memory (OGM) and both rumination on general themes, and impaired executive control, however there was no support for a relationship with functional avoidance in this group. There is therefore evidence supporting each aspect of the CaR-FA-X model as a mechanisms of OGM in younger populations, although some contrasting findings for functional avoidance as a mechanism. This information is useful as it enables us to consider potential overlaps with the mechanisms of OGM in older adults.

1.8. Mechanisms of age-related OGM:

The have been similar mechanisms reported in ageing research on OGM. As discussed earlier in Section 1.3, deterioration in executive function is also suggested to account for age-related OGM in older adults. In terms of functional avoidance (FA), however, there appears to be a crossover effect with age. Sumner (2014) found no evidence to support the suggested role of FA in AMS in younger adults, although they did not examine positive and negative recall separately. Furthermore, Ros, Latorre, Serrano, & Ricarte (2017) examined all three mechanisms of the CaRFAX model in healthy older adults compared to younger adults and found that lower functional avoidance was only related to better AMS in older adults. Alongside findings that older adults are able to moderate negative affect more effectively than younger adults (Carstensen, Pasupathi, Mayr & Nesselroade, 2000), Ros et al (2017) concluded that although older adults use fewer avoidant style strategies than younger adults overall (Amirkhan & Auyeung, 2007; Blanchard-Fields & Irion, 1988; Blanchard-Fields & Sulsky, 1991), they are more efficient at using them to control negative affect. In other words, older adults are more effective at utilising executive control processes to avoid the experience of emotions attached to negative specific memories. A potential explanation is that whilst in depressed younger adults FA becomes maladaptive and results in OGM to positive as well as negative memories, older adults use FA as an adaptive strategy to reduce the affect associated with negative specific memories. Ros et al (2017) did not separate positive and negative AMS either. However, Serrano, Latorre, & Gatz (2007) provide evidence that older adults with depressive symptoms only show OGM to negative cues. This explanation is in line with the positivity effect in older adults, as suggested by the socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999). According to this theory, as people age and the future is perceived as less open-ended, they prioritise more emotionally based goals. Thus, there is a shift in focus towards positive material that is more emotionally gratifying in

the present. This supports that FA of negative cues in older adults may lead to OGM due to an increased focus on emotional regulation in later life.

There are findings of cognitive control processes being used to enhance positive memories and diminish negative memories in later life (Mather & Knight, 2005). Holland et al (2012) also found that although executive function predicted specificity in older adults, it did not predict greater *positive* recall. This is in line with the suggestion that emotional processing of positive memories is achieved by some automatic process, bypassing the executive control route, and is thus less affected by age-related executive decline (Scheibe & Blanchard-Fields, 2009). The positivity effect in older adults may thus act as a buffer against the negative impact of executive function decline on autobiographical specificity. Holland et al (2012) suggest that this represents a potential target for interventions to improve autobiographical specificity in older adults. Chapter 3 of this thesis will explore this suggestion by comparing an intervention which focusses on specific positive recall only (life review-see Section 1.9) to an intervention that includes both positive and negative recall, and which focusses more on executive function (MEST- see Section 1.9). This examination will help us to understand the how different mechanisms underlying AM retrieval (i.e. the positivity effect and reduced executive control) may differentially influence the effectiveness of AM training with older adults.

1.9. Interventions:

Together, this research advocates that AM specificity training may have positive outcomes for older adults' independence, mental health, and ability to engage in social and intellectual activities, which consequently help preserve cognitive function via a reciprocal relationship (Hultsch et al., 1999; Schooler & Mulatu, 2001). Based on this, interventions have been developed that aim to reduce OGM in various populations, including depressed younger adults, depressed older adults and non-depressed older adults. This thesis assessed the effectiveness of three methods of improving AM specificity, and consequently their effect on wellbeing, with the aim of developing a preventive intervention for older adults with memory problems.

Cognitive flexibility (MemFlex) programme:

Hitchcock et al (2015) developed a memory flexibility programme (MemFlex) as an intervention for depression that aims to improve flexibility of autobiographical memory retrieval. Depressed individuals may ruminate on over-general negative material as a

mechanism of functional avoidance in order to down-regulate the negative affect associated with specific memories. However, depressed individuals have also been found to exhibit OGM to positive cues (Williams et al., 2007), thus suggesting inflexibility between specific and general AM may become a maladaptive response. Cognitive inflexibility has previously been supported as a characteristic of depression (Gotlib & Joorman, 2010), and is considered to be a vulnerability factor for the development of future depression (Mathews & MacLeod, 2005). Dritschel, Beltsos, & McClintock (2014) highlight that flexibility in AM retrieval is important to everyday functioning, as both specific and general memories are beneficial for different contexts, e.g. specific memories are more useful for social problem-solving (Goddard et al., 1996) whilst general memories are useful for planning future activities based on general information about activities in the past (e.g. “I always go to Spanish class on a Monday”).

Dritschel et al (2014) found that increased ratings of depressive symptomatology and rumination in a non-clinical sample were related to reduced specificity on the Autobiographical Memory Test with alternating instructions (AMT-AI), which required participants to switch between general and specific memories, but not on the standard AMT. This implies that reduced cognitive flexibility with depression is related to reduced AM specificity, and that the AMT-AI may be a more sensitive measure of reduced AMS in non-depressed populations. Reduced cognitive flexibility may therefore be a key executive processing deficit that contributes to reduced AMS in depression, and may represent an important vulnerability marker. Preventative interventions should therefore target this ability to shift from a general to specific memory retrieval style. Given that older adults also exhibit age-related deficits in cognitive flexibility (e.g. on the Wisconsin Card Sorting Test; Taconnat et al., 2009), it is plausible that reduced cognitive flexibility may also explain age-related OGM due to difficulty performing a controlled retrieval search.

The MemFlex intervention developed by Hitchcock et al (2015) targets maladaptive cognitive patterns observed in depression, such as reduced cognitive flexibility and a bias towards negative material (Gotlib & Joorman, 2010; Williams et al, 2007). The programme is based on a combination of cognitive bias modification treatment and memory specificity training (MEST). MemFlex has had promising results with findings of improved AMS and problem-solving in an uncontrolled trial with adults with remitted depression (Hitchcock et al, 2016), and of improved AM flexibility and depression measures in a randomised controlled trial with depressed adults (Hitchcock et al.,

2018). The MemFlex programme targets multiple cognitive biases as it attempts to reduce automaticity towards negative memories, but also towards general memories. We have seen that older adults also have a more general style of processing (Craik and Rose, 2012) and a difficulty retrieving specific memories compared to younger adults. Thus, age-related reduced cognitive flexibility could potentially explain the production of OGM in older adults. MemFlex aims to improve the way specific and general AMs are retrieved alternately in everyday life for different contexts, which is also in line with Hertzog et al (2008)'s suggestion that cognitive ageing research should focus on interventions that target cognitive mechanisms that relate to everyday functioning, rather than focusing on basic underlying cognition. This thesis will examine this theory and assess the effectiveness of the MemFlex programme with healthy older adults in Chapter 2. The potential for the positivity effect acting as a buffer against the negative impact of executive function decline on autobiographical specificity, as discussed in Section 1.8, will also be examined.

Life review:

Latorre et al (2013) propose that programs to enhance successful ageing should focus on aspects of life review and reminiscence. Traditional life review methods are a form of structured reminiscence, developed from Butler's (1963) definition of life review as "a naturally occurring, universal mental process characterised by the progressive return to consciousness of past experiences, and, particularly, the resurgence of unresolved conflicts" (Butler, 1963, p.66). Whilst 'reminiscence' is the process of recollecting memories, 'life review' is a structured process of integrating memories of the self in the past with the present (Bluck & Levine, 1998). Butler (1963) proposed that this process occurs more often in older age because a need to frame a meaningful picture of one's life is prompted by the nearness of death. According to Butler, this form of reminiscence may either occur simultaneously or be guided.

Life review has since been developed as a tool to either promote wellbeing in healthy older adults, as a therapy for depression, or for people who are more vulnerable to developing depression, such as residents of nursing homes (Haight, Michel, & Hendrix, 1998). The aim of these traditional life review methods is to help people to evaluate the past, framing past events in a positive narrative in order to ascribe meaning or value to one's life. This was developed from Erikson's life span developmental theory (Erikson, 1963. cited in Coleman 2005, p. 260) which describes achieving integrity and acceptance as the last psychosocial stage of life. There is a wealth of research on various methods of life review, therefore only a summary of key topics relevant to the

current thesis are discussed here. Meta-analysis studies have found that reminiscence and life review techniques have been effective at reducing depressive symptoms (Bohlmeijer, Smit, & Cuijpers, 2003; Pinquart, Duberstein, & Lyness, 2007; Pinquart & Forstmeier, 2012). Interventions involving processes of reminiscence and reviewing one's life have also been suggested to help people with memory difficulties maintain a sense of self and identity (Dempsey et al, 2014), and life review has been shown to improve mood in people living with dementia (Haight, Gibson, & Michel 2006).

Despite the vast research within this area, there is a lack of support for life review methods as evidence based interventions. This is partly due to an inconsistency in the literature about the definitions of 'reminiscence' and 'life review', the different types of methods used (e.g. attending reunions, family history, writing an autobiography, the use of photographs or music), and the outcomes measured, e.g. depression, ego integrity, cognitive function, meaning in life, acceptance of death (Lin, Dai & Hwang, 2003; for review see Bluck and Levine, 1998). Bluck & Levine (1998) identified the need to bridge a gap between Butler's theoretical work on life review, and the empirical work needed to support its use in both practice and research. They suggest that the empirical strength of autobiographical memory studies may provide such support since this area of research has revealed similar concepts to Butler's psychodynamic theories. This view could lead to research that is more valid in predicting the outcomes of life review intervention methods (Bluck & Levine, 1998). Westerhof & Bohlmeijer (2014) also agree that linking the literature on reminiscence and life review with the cognitive literature on autobiographical memory will help to progress this field of research. This innovative approach could lead to a better understanding of the underlying processes that make life review effective, and therefore generate stronger evidence for life review interventions.

Linking life review and autobiographical memory (AM):

Bluck & Levine (1998) propose that life review is a type of reminiscence, and that reminiscence is a type of AM. In this sense, AM is seen as the cognitive system that encodes, stores and guides retrieval of memories, whilst reminiscence is a process used to access these memories for the purpose of life review. In a paper by Westerhof and Bohlmeijer (2014), the authors highlight three broad functions of reminiscence, and provide suggestions as to how autobiographical memory research may be linked to reminiscence and life review. The three functions of reminiscence they distinguished were; social, instrumental, and integrative. Each of these can be related to the three broad functions of autobiographical memory set out by Bluck (2003); self, social and

directive. The social function refers to reminiscing and sharing memories with others to foster intimacy. Instrumental functions include the use of memories as a coping strategy, for example, recalling positive memories to regulate emotion, or recalling strategies used in the past to help solve current problems, similar to the 'directive' function of AM. Lastly, the integrative function of recalling the past to maintain or adapt one's identity, particularly in times of change, relates to the 'self' function of AM. For example, recalling memories related to being a mother, a teacher or a keen gardener when moving to a retirement village and meeting new people. This suggests that life review is a structured process that is naturally aligned with the broader functions of AM. Whilst most AM interventions take more of a top-down approach by training the cognitive process of searching for a memory for a particular use, life review may be more of a bottom-up approach, drawing on the innate functions of the AM system by directing the natural process of reminiscence. One of the aims of Chapter 3 was to compare life review with what could be said to be a more top-down approach to training AMS, i.e. MEST, in order to determine which is most suitable for older adults.

Common theme of 'self' in AM and life review:

Research into life review and autobiographical memory mainly converge on the theme of 'self'. Bluck and Levine (1998) present a model highlighting the reconstructive nature of memory. They suggest that the organisation and retrieval of autobiographical memories are guided by a cognitive 'self' schema. This builds on Bartlett's (1932) original view that memories are reconstructed from fragments of information that have been encoded and retrieved according to one's schema. This schema is based on personal attitudes and beliefs and is used to selectively attend to information in order to summarise and cope with information from an ever-changing environment. Bluck and Levine (1998) propose that the 'self-schema', described as a cognitive structure containing knowledge from long term memory related to the self, is used to organise and guide retrieval from a hierarchical AM system. This is in line with Conway and Pleydell Pearce's (2000) view that specific AMs are selectively retrieved from a larger AM knowledge base according to current themes or goals. For example, a positive 'self' schema used to view the current self as 'happy' may guide the retrieval of positive themes such as 'things that make me happy'. This theme guides the selection of progressively more specific memories, e.g. "Going dancing used to make me happy", followed by "I was very happy the day I won a prize in a dancing competition". Thus, when specific memories are recalled, they are reconstructed according to the current 'self-schema' or context.

Therefore, life review may be a cognitive function used to integrate the past 'self' with the present, to resolve any discrepancies and maintain or develop a sense of continuity. In other words, old autobiographical memories are reconstructed with new meanings in order to provide a coherent, meaningful picture of the self in the present (Barclay, 1996). For example, memories of scary events are recalled by the individual as being fearless in order to adapt to a current view of the self as fearless. Life review may therefore be helpful in enhancing self-esteem, by re-interpreting one's life in accordance with a schema, bolstering acceptance of both positive and negative aspects of self. Bluck and Levine (1998) point out that this process is important for self-growth or self-acceptance at any age, and not just in clinical populations. The authors discuss how reminiscence processes should be viewed as a cognitive function rather than as a 'therapy', and how reminiscence techniques, such as life review, are not just used for depression but are often used as a tool to promote self-acceptance in older adult populations. We explore the use of a life review technique to promote wellbeing in healthy older adults in Chapter 3, and seek to understand the mechanisms underlying the effect of this intervention, such as a focus on positive meaningful memories likely to be related to the self, by comparing it to a more cognitive focused strategy (i.e. MEST, as discussed in Section 1.9).

Incorporating AM specificity into life review:

Westerhof & Bohlmeijer (2014) discuss how AM may be incorporated into life review research. The process of linking autobiographical memories of specific events containing episodic details to more general concepts about the self has relevance to life review. In this process, meaning is abstracted from specific memories and is connected to the 'long-term self' at a semantic level. This helps us to achieve insight and provides a coherent narrative, or sense of wholeness of one's entire life (Singer, Blagov, Berry, & Oost, 2013). This integrative process has been termed 'autobiographical reasoning' or 'meaning-making' and is suggested to be important to psychological wellbeing, alongside memory specificity (Thorne, McLean, & Lawrence 2004; Singer et al., 2013). Being able to recall the vivid details of specific 'self-defining' memories is essential to mental wellbeing, since these are emotionally intense memories that contribute to the development of one's identity. Re-experiencing these specific memories serves a cognitive function in the pursuit of goals; they provide detailed information to help predict not only the likelihood of a desirable outcome, but the affective experience of this outcome. Thus, the ability to recall SDMs can support goal achievement and emotion regulation (Blagov & Singer, 2004; Josephson, Singer,

& Salovey, 1996). In addition, the ability to connect these memories into a narrative theme, and to link this to an enduring, longer term sense of self, i.e. 'meaning-making', is also important to wellbeing. In this way memories can be used to "explain, reveal or cause change in the self" (Singer et al., 2013 p 575), or in other words, for the promotion of 'self-growth', as is one of the aims of life review.

Over-generalisation, or a difficulty recalling specific memories, however, can lead to maladaptive functioning because it limits access to the useful information contained within SDMs. Similarly, maladaptive meaning-making can lead to psychological dysfunction as negative meanings are attributed to memories and become generalised, e.g. a depressed individual may attribute failing an exam to being useless, which leads to a generalised view of oneself as being 'useless'. Westerhof & Bohlmeijer (2014) suggest that examining cognitive functions such as autobiographical memory specificity (AMS) and 'autobiographical reasoning' in relation to reminiscence and life review processes could help gain insight and develop more effective interventions. AM retrieval may also be thought of as a cognitive control mechanism used for the purpose of emotion regulation in later life, i.e. to enhance positive memories and diminish negative memories (Mather & Knight, 2005), explaining the positivity effect in older adults. Thus, autobiographical reasoning may be viewed as a process used to enhance self-esteem, by attaching events to a positive meaning. Life review similarly focusses on using reminiscence processes to balance positive and negative memories, helping to overcome unresolved conflicts and find meaning in past experiences (Lashley, 1993). Therefore, AMs serve a self-enhancing function, and over-generalisation of memories impairs their use for emotion regulation. Combining the cognitive literature on this key function with existing life review interventions may help to strengthen the positive effect life review has on mood.

Life review interventions:

Serrano, Latorre, Gatz and Montanes (2004) examined the effects of a life review programme that had a particular focus on improving AMS in clinically depressed older adults. The authors proposed that practicing recalling memories of specific events is an important component that may account for the effectiveness of life review methods, since it may reduce over-general memory and the associated rumination on negative material common in depression. The intervention lasted four weeks and required participants to answer 14 questions each week that were designed to prompt specific memories of positive events from a different life period (childhood, adolescence, adulthood, and a summary), e.g. "Tell me about a day when you were an adolescent

and you did something out of the ordinary". Serrano et al's (2004) method adds empirical strength to the life review literature by focussing on the well-documented cognitive marker of OGM in depression. They found that the intervention group exhibited improved AMS, increased life satisfaction scores, and a reduction in depressive symptoms compared to controls. The change in AMS also significantly predicted mood, supporting the suggestion that AM retrieval practice is a key mechanism underlying the beneficial effects of life review.

The questions participants were asked in Serrano et al's (2004) method may have triggered recall of specific events that participants might not have spontaneously reviewed in a less structured form of reminiscence. In an analysis of the concept of 'reminiscence' in dementia care, Dempsey et al (2014) state that one of the antecedents of reminiscence is the participant's ability to recall memories, and that remote memories such as those recalled from childhood, are usually the last to deteriorate in older adults (Lin et al, 2003). Thus, in a sense, reminiscence processes focus on preserved abilities, rather than focussing on impairment (Dempsey et al, 2014). Stimulating remote memories has also been suggested to improve general cognitive function (Lin et al, 2003). Serrano et al's (2004) life review program provides a structured approach to improve mood by reducing over-general memory, but also by stimulating preserved memories that may not have been recalled through spontaneous reminiscence. Recalling remote memories may be important to the goal of ego integration, since a deterioration of an individual's autobiographical memory may result in their past becoming disconnected from their present (Dempsey et al, 2014). In addition, the focus on positive memories in Serrano's method may explain the beneficial effect on mood. It has been evidenced that reduced rumination on negative events is one of the mediators of life review's effectiveness (Lamers, Bohlmeijer, Korte, & Westerhof, 2015). Lamers et al (2015) found that ego integrity (which refers to looking back on one's life with positive self-acceptance) and reduced rumination, partly mediated the effects of an online self-help life review intervention on depressive symptoms. This supports the theory that life review methods are successful due to an effect of decreasing rumination on negative memories and enhancing positive memories which are incorporated into a positive life narrative, thus boosting ego-integrity. Serrano et al's (2004) method similarly targeted these two mediators by reducing over-general memory which is related to rumination (Raes et al, 2006), and by encouraging recall of positive events from the participant's life.

Lattore et al's (2015) findings provide further support for the suggestion that life review methods are effective due to their effect on reducing access to negative memories, and enhancing specificity of positive memories. Lattore et al (2015) conducted a similar life review programme to Serrano et al's (2004) (but extended it to 6 weeks) with non-depressed older adults, compared to an active control group. All participants were already taking part in an active ageing programme. Lattore et al (2015) found that those who had completed the life review programme had significantly decreased depressive symptomatology, improved life satisfaction, and increased recall of specific memories. Thus, there is evidence that life review is a successful method of improving specificity of AM in non-depressed older adults (Latorre et al, 2015), as well as depressed older adults (Serrano et al., 2004). This implies that it may be a useful tool for successful ageing, for example, for people who are not depressed but have mild psychological distress, or to help cope with adversities such as loss, bereavement, moving home, etc (Webster, Bohlmeijer, & Westerhof, 2010). Lattore et al (2015) advocate the use of a life review programme as a preventive strategy as part of an active ageing programme to enhance emotional wellbeing in healthy older adults. One limitation of Latorre et al's (2015) study was that there was no follow up period. In the current body of work the benefits of life review as a standalone intervention, rather than part of an active ageing programme, were assessed following the same protocol as Serrano et al (2004), but including measures of mood, independence and social function, and including a 3-month follow up period to assess whether any changes are maintained over time.

Reduction in specific negative memories significantly predicted increased life satisfaction in Latorre et al's (2015) study. This supports the theory that a life review training programme to increase access to specific positive memories has a beneficial effect on mood by reducing access to negative memories. The current thesis explored this proposed mechanism by comparing an intervention which focusses on specific positive recall only (life review) to an intervention that includes both positive and negative recall (MEST). This examination will help confirm whether it is the focus on positive memories that underlies improved mood, or whether improving the cognitive process of retrieving AM has an effect on mood regardless of valence. How the different methodologies of life review and MEST affect their usefulness in an older adult population was also examined. For example, life review is conducted in the context of one's whole life and thus contains an element of 'meaning-making', whilst MEST is conducted with the aim of improving AM retrieval systematically as a cognitive process. Comparing these will highlight the benefits and shortcomings of each

methodology. An examination of life review with older adults in this thesis can help answer the question: Does life review have a positive effect on mood because it targets the cognitive process of retrieving specific AMs?

Memory Specificity Training (MEST):

As a result of the evidence presented earlier for OGM as a vulnerability factor for depression, an intervention was developed to target this marker named 'Memory Specificity training' (MEST; Raes, Williams, & Hermans, 2009). Raes et al (2009) developed the Memory Specificity Training (MEST) as a group based stand-alone intervention to directly target AM specificity for both negative and positive material as a therapeutic method. The aim of their study was to examine whether MEST can effectively reduce OGM since it is clearly implicated in the development and maintenance of depression (William et al., 2007), and to examine whether improvements in AMS were related to improvements in a range of potential mediating factors as discussed earlier, e.g. reduced problem-solving or relationship to rumination. They examined the effectiveness of MEST with a sample of female inpatients with depression. Firstly, they found that those in the intervention group had significantly improved AMS following training, even after controlling for any improvements in depression symptoms. Thus, the changes in specificity were due to the training, rather than any reduction in depressive symptoms. This is important because other treatments for depression do not have an effect on AMS, even after recovery from depressive symptoms. Therefore, the MEST programme successfully targeted this enduring characteristic of depression and may therefore be useful in the prevention of depression in those with this known vulnerability factor.

Secondly, Raes et al (2009) examined mediating factors and found that improvement in specificity was related to reduced rumination and experiential avoidance, and to improved social problem-solving ability. This supports the previous literature that proposes that these are mediating factors in the relationship between AMS and depression. It also validates the MEST programme as an effective strategy to modify these factors via its effect on memory specificity. Finally, Raes et al (2009) found that increased specificity generalised to another measure of AM specificity, the Sentence Completion for Events from the Past Tense (SCEPT). In this task participants were given the beginnings of sentences which probed memories of past events, and were asked to complete the sentences. Participants completed these sentences with higher specificity after the training, compared to before training. This highlights the reliability of

the MEST programme as the improvement in specificity was not limited to the standard cue word task (AMT).

Overall, Raes et al's (2009) study demonstrates that one of the core cognitive processes that is a vulnerability factor for depression: reduced AMS, can be ameliorated by this intervention, and is also associated with an amelioration of the proposed mediating factors of depression. The observed improvements on the proposed mediating variables provide promising results to suggest there may be longer term improvements in depressive symptoms. Neshat Doost et al (2013) later examined the effects of MEST training in a sample of Afghan adolescents with depression compared to a control group who had no additional contact, and included a 2-month follow up. They found that the intervention group had higher memory specificity following training, and had lower levels of depression compared to the control group at 2-month follow up. Furthermore, change in AMS mediated a relationship between group type and reduction in depressive symptoms, and was a better predictor of reduction in depression than baseline depression. This suggests a causal relationship between the improvement of AMS through MEST, and reduction of depression.

The efficacy of MEST has also been studied in a group of patients with Post-Traumatic Stress Disorder (PTSD) (Moradi et al., 2014). Over-general memory style (OGM) in PTSD is thought to be a cognitive avoidance strategy to avoid the experience of negative emotions attached to the trauma initially, but which then generalises to other situations. Thus, OGM retrieval style becomes a maladaptive response to normal everyday situations and prevents recovery from PTSD because specific memories of the trauma cannot be accessed in order to be updated and re-scripted (or reviewed). Moradi et al (2014) found that the MEST intervention was successful at modifying this cognitive marker of reduced AMS. The intervention groups also displayed reduced PTSD symptoms, following training and at 3-month follow up. Thus, even though the MEST did not directly target trauma memories, it enabled participants to modify their cognitive avoidance style and to engage with specific memories. It appears this change in retrieval style may have generalised to trauma memories, meaning that these memories could be re-scripted and integrated to reduce their intrusiveness, thus reducing PTSD symptoms of avoidance and intrusiveness. This supports the similar relationship between AMS and depression via the mediating factor of avoidance. In depression, over-general memory may be an avoidance strategy of negative emotions attached to specific events. The results of Moradi et al (2014) emphasises the importance of AMS in dealing with these negative emotions. This is in contrast to the

purpose of Serrano et al's (2004) life review intervention which focusses on the positive appraisal of AMs. Thus, life review may be more closely aligned to findings of a positivity effect in the ageing literature. It is possible MEST could help older adults deal with negative past experiences in a similar manner in which it helps younger depressed adults. Alternatively, it is possible that older adults are already successful at moderating negative affect, as discussed in Section 1.8. MEST has not yet been conducted with older adults, therefore one aim of the current body of work was to explore whether the theories underlying MEST (i.e. reduced executive control mediates reduced mood via increased rumination and avoidance) are also relevant in a sample of older adults.

1.10. Aims and overview:

Based on the evidence presented, it is clear that AM is an essential target for maintaining wellbeing in older adults. Autobiographical memory is an aspect of cognition that refers to personally experienced events and is distinct from other types of memory due to its functional role in everyday life, its relation to the self and the social environment. Whilst older adults have a difficulty in retrieving specific AMs, higher AMS is associated with better mental wellbeing (Latorre et al., 2013), better social functioning (Beaman et al. 2007) and less functional limitations in everyday life (Holland et al., 2016). In addition, enhancing AMS may contribute to cognitive reserve by enabling older adults to remain actively engaged in social activities which are intellectually stimulating, and by preventing depression which is a risk factor for cognitive impairment (Chung et al., 2015). The literature outlined in this chapter therefore highlights AMS as a potential key target for healthy ageing interventions. This thesis aimed to investigate methods of improving retrieval of specific autobiographical memories in older adults. It was hypothesised that participants taking part in each of the intervention groups would exhibit significant improvements in retrieval of specific autobiographical memories. Due to the evidence supporting a relationship between AMS and other indicators of wellbeing, it was further predicted that improvements in AMS would also be associated with improvements in self-rated mood, improved social problem-solving, and reduction in functional limitations. The long term aim of this research is to develop an intervention that can be used in supported living and care environments by trained carers as a preventive strategy for decline in cognitive and social functioning.

Chapter 2 aims:

In the first phase of this thesis, the MemFlex intervention (Hitchcock et al. 2015) was examined in order to assess whether improving cognitive flexibility in older adults would have a positive impact on flexible navigation of the AM store, ultimately enhancing ability to access specific memories and reducing automaticity to general memories. Another key aim was to investigate the hypothesis that positive specific memories are unaffected by reduced executive control in older adults. This is based on the suggestion that whilst functional avoidance (FA) becomes maladaptive and results in OGM to positive as well as negative memories in depressed younger adults, older adults are better at regulating the emotional content of memories and use FA as an adaptive strategy to down-regulate negative affect.

Chapter 3 aims:

Based on previous evidence that OGM can be reduced through training in younger depressed groups (Raes et al, 2009; Neshat-Doost et al, 2013; Moradi et al, 2014) and in older groups (Serrano et al 2004; Latorre et al, 2015), in Chapter 3, two existing AM interventions originally developed to reduce depression-related OGM were examined as strategies to reduce age-related OGM. A further aim of Chapter 3 was to explore the potential mechanisms underlying effectiveness of AM training methods with older adults, i.e., positive appraisal and executive function by comparing two interventions with different focal points (life review and MEST). MEST focusses more on training the executive function component of both positive and negative AM retrieval to reduce generalisation by systematic practice, whilst life review focusses on the theme of 'self' and enhancing specific positive memories, whilst reducing access to negative memories. A central aim was to compare which of these approaches is the most appropriate for an older adult population overall, taking into account effectiveness and acceptability. A second smaller study was also included to assess the effect of group benefits of the MEST intervention by comparing MEST delivered in a group format with MEST delivered in a workbook format.

Chapter 4 aims

In Chapter 4, the use of the intervention which was identified as the most appropriate in healthy older adults in Chapter 3, i.e. life review, was examined as a preventive strategy in a clinical sample. People with amnestic Mild Cognitive Impairment (aMCI) are at high risk of developing dementia (Ravaglia et al., 2006). This condition affects AMS so that people with aMCI have significantly reduced AMS compared to healthy older adults, but higher AMS compared to people with dementia. Therefore, aMCI

represents an intermediate stage in the deterioration of AM. AM is proposed as an important target for preventive interventions since it is linked to the risk factors associated with further cognitive decline, i.e. social functioning, depression and maintaining an independent, active lifestyle. However, to our knowledge, the use of AM training methods in an aMCI population has not yet been investigated. This thesis therefore aimed to assess whether life review could have a positive impact on improving AMS in aMCI and subsequently improve life satisfaction, mood, social functioning and independence.

Chapter 5 aims

In Chapter 5 the acceptability of the life review intervention with participants with aMCI was explored using semi-structured interviews. Through this qualitative process, the aim was to gain an understanding of the experience of the life review intervention from the participant's point of view. This can be used to help to inform future improvements to its delivery and design, and to help explain any quantitative effects from Chapter 4.

Chapter 2: Memory Flexibility training for autobiographical memory in healthy older adults

2.1.Introduction:

Higher autobiographical memory specificity (AMS) has a protective effect on mental health in non-depressed older adults (Latorre et al., 2013). Interventions that lead to improved AMS have been shown to reduce depression in younger adults (Raes, Williams & Hermans, 2009), whilst improved AMS is linked to enhanced social problem-solving (Beaman, Pushkar, Etezadi, Bye, & Conway, 2007), and reduced functional limitations (Holland et al, 2016) in older adults. Therefore, reducing over-general memory (OGM) has been a target for memory-based interventions in older adults (e.g. Latorre et al, 2015).

However, Dritschel, Beltsos and McClintock (2014) argued that the ability to be flexible in the retrieval of specific and general memories under different circumstances may be more important than specificity for successful functioning in everyday life. This was based on Dalgleish et al's (2007) finding that depressive symptoms were not only related to reduced ability to recall specific memories, but also ability to voluntarily recall general memories. Dritschel, Beltsos, & McClintock (2014) extended this to discover that depressive symptoms were also related to a difficulty in switching between retrieving specific and general memories. Furthermore, they suggested that memory flexibility could underpin important functions such as emotion regulation, for example, for up-regulating positive memories or for shifting sets, i.e. disengaging rumination on negative memories, which also has implications for mental wellbeing. This has led to the suggestion that depression is associated with a reduced ability to flexibly navigate the hierarchical AM store, not simply a difficulty with specificity (Hitchcock et al, 2018). Therefore, although reduced flexibility may affect both specific and general retrieval, when navigating the hierarchical system general memories are located at the upper end and are more readily accessed, whilst specific memories are located lower and are particularly difficult to access. Given the proposed importance of flexible AM retrieval for everyday functioning in relation to mood regulation (Dritschel et al., 2014), and the importance of improving specific recall, interventions targeting flexibility could be particularly beneficial for older adults.

Cognitive flexibility and AM retrieval:

Older adults often face uncertain circumstances, e.g. bereavement, moving home or retirement, which may adversely affect their well-being. The ability to quickly recover from challenges experienced in everyday life, often referred to as resilience, is an important factor in healthy ageing. Such resilience requires flexibility to be able to adapt to a changing environment. Flexibility is important to psychological wellbeing, but is a wide concept that can refer to a range of different processes. In a review, Kashdan and Rottenberg (2010) highlight the process of flexibility in relation to executive function. According to Miyake et al (2000), executive function consists of three factors: shifting, updating, and inhibition. The use of these abilities to recognise and update the requirements of a specific situation and adapt to changes in demand is integral to being flexible (Kashdan & Rottenberg, 2010). This specific use of executive control will be referred to as “cognitive flexibility” within this thesis.

Inhibition and initiation are key processes embedded within cognitive flexibility since previous habitual or automatic responses are inhibited and novel search strategies are initiated (Eslinger & Grattan., 1993; Dritschel et al., 2014). These processes are also required for verbal fluency tasks whereby participants must search for new categories of words. Cognitive flexibility has therefore been measured using verbal fluency tasks (Heeren, Van Broeck & Philippot, 2009) and the Random Number Generation task (RNG; Towse & Neil, 1998) which requires inhibition of automatic responses and initiation of novel responses. Furthermore, this process is analogous to the hierarchical model of AM retrieval, as general memories must be inhibited and a search for more remote specific episodic details must be initiated (Conway & Pleydell-Pearce, 2000). Therefore, reduced flexibility may result in perseveration on general memories, and a difficulty overcoming this to access specific memories. As such, we propose that cognitive flexibility is an integral component to the retrieval of specific AMs in this hierarchical manner.

Evidence from the depression literature supports the suggestion that cognitive flexibility underlies AMS. For example, Dalgleish et al (2007) demonstrated that depression is related to an impaired ability to inhibit automatic responses, resulting in perseveration on previous rules or habitual responses. Williams and Dritschel (as cited in Heeren et al, 2009) also found that OGM was negatively correlated with a cognitive flexibility task (verbal fluency). Both OGM and cognitive inflexibility are integral features of depression in younger adults (Grant, Thase & Sweeney, 2001; Dritschel et al, 2014). Furthermore, a previous intervention study using mindfulness based cognitive therapy with healthy adults found that improvement in cognitive flexibility (measured via a verbal fluency

task) facilitated a reduction in over-general memory retrieval (Heeren et al, 2009). The authors explain this by suggesting that cognitive flexibility is required for mindfulness training to shift the focus of attention to different objects, e.g. to disengage from intrusive thoughts and focus on breathing or bodily sensations. This is similar to how attention is disengaged from general memories, which capture attention automatically, towards more specific, episodic information. Therefore, the authors concluded that an OGM bias may reduce if cognitive flexibility is increased.

Dritschel et al (2014) developed a measure of AM flexibility with non-depressed university students - the Autobiographical Memory Test-Alternating Instructions (AMT-AI), whereby participants had to switch between retrieving general and specific memories. Perseveration on general memories in the switching task impacted ability to retrieve specific memories in particular, whilst general retrieval was relatively unimpaired. Furthermore, only specific retrieval was negatively correlated with depressive symptomatology and rumination. This is important as it suggests flexibility particularly impairs specific retrieval and may be an important factor for interventions for people who may be vulnerable to developing depression, but whose symptoms are not currently clinically significant. However, the authors did not include a non-memory measure of cognitive flexibility, meaning it is unclear whether difficulty in flexibly retrieving specific memories is related to a more general deficit in cognitive flexibility.

Older adults have been shown to exhibit age-related deficits in cognitive flexibility (measured by number of perseverative errors on the Wisconsin Card Sorting Test; Taconnat et al., 2009). Thus, in addition to depression-related OGM, reduced cognitive flexibility may also explain age-related OGMs due to difficulty performing a controlled search. Given the link between cognitive flexibility and AMS, alongside evidence for reduced AMS and reduced cognitive flexibility in older adults, the current study aimed to examine if a novel intervention (Memory Flexibility programme [MemFlex]; Hitchcock et al., 2015), which targets flexibility within the domain of AM, would lead to improvements in AMS in older adults. Since flexibility in AM retrieval in relation to general cognitive flexibility has not yet been examined in older adults, our secondary aim was to examine the effects of MemFlex training on cognitive flexibility measured with a verbal fluency task, and on the executive functions that underlie cognitive flexibility, i.e. Updating and inhibition (measured using the RNG task). It is expected that if cognitive flexibility does underlie flexibility in AM retrieval, then the practice provided by MemFlex, e.g. switching responses between alternating task instructions, would engage these cognitive functions and thus have an impact on

performance in these skills. It was also expected that MemFlex would enhance older adults' ability to perform a controlled retrieval search for specific memories via the route of improved cognitive flexibility. This may be more effective than only providing direct practice in specific recall as previous AM interventions have done (e.g. Raes et al, 2009), since it is a targeted at a specific cognitive process underlying AM retrieval, as opposed to simply practising the task that is being measured (i.e. recalling specific memories in response to cue words).

Positivity effect:

Cognitive flexibility may also be useful for increasing attentional control over bottom-up, automatic processes which are more likely to be guided by emotions, and is therefore particularly relevant to emotion regulation (Kashdan & Rottenberg, 2010). There is evidence that healthy older adults use cognitive control processes for emotion regulation to enhance positive memories and down-regulate negative memories (Mather & Knight, 2005). This results in biases in attention and memory retrieval processes towards positive material in older adults, referred to as "the positivity effect" (Carstensen, Isaacowitz & Charles, 1999; Mather & Carstensen, 2005). However, Holland, Ridout, Walford, & Geraghty (2012) found that although the updating aspect of executive function predicts overall specificity in older adults, it does not predict specific positive recall, suggesting that specific positive recall is not influenced by reduced executive control in older adults. Therefore, the role of executive control in flexibility between positive and negative recall in older adults is unclear. One of the purposes of MemFlex in younger adults is to enhance flexibility between positive and negative memories, enhancing ability to up-regulate positive memories when they are useful to the situation. In the current study, the effects of MemFlex on older adults' ability to retrieve positive and negative memories will be examined. This will help to determine if the positivity effect protects from any detrimental impact of age-related reduced cognitive flexibility. It was expected that since older adults are already successful at up-regulating positive recall, there would be limited effects on positive specific recall compared to negative specific recall. Furthermore, based on the combination of the evidence presented above for role of cognitive flexibility in specific retrieval, it was expected that MemFlex would be particularly helpful for improving specific retrieval in people with lower cognitive flexibility at baseline.

Aims and hypotheses:

The current study aimed to examine the effects of MemFlex on two primary outcomes: cognitive flexibility and specific AM retrieval, in non-depressed older adults. It was hypothesised that since cognitive flexibility is integral to the generative search process, participants in the MemFlex condition would exhibit significant improvements in cognitive flexibility (measured using a verbal fluency task), as well as the executive functions underlying this skill (i.e. Updating and inhibition), and in autobiographical memory specificity (AMS), relative to controls. Previous AM training methods have been shown to have long lasting effects on memory specificity (Moradi et al., 2014; Neshat Doost et al., 2013), therefore it was predicted that effects on primary outcomes would be maintained at 3-month follow-up in the MemFlex group. Changes in these two primary outcomes were expected to be positively correlated.

Due to the relationship between AMS and social problem-solving ability, independence, and depression, it was hypothesised that MemFlex participants would also exhibit improvements on these secondary outcome measures relative to controls, and that changes in these variables would be positively related to changes in AMS. It was predicted these effects would also be maintained at 3-month follow-up since MemFlex is designed to help participants incorporate the skills learned into their everyday lives.

Based on evidence that older adults successfully use cognitive control processes to regulate emotion in line with the positivity effect (Mather & Carstensen, 2005), it was hypothesised that there would be a bias towards recalling positive specific memories compared to negative specific memories across both MemFlex and control groups. Since the “positivity effect” protects positive memories from impaired specificity because older adults are generally better at recalling positive material compared to negative (Kwon, Scheibe, Samanez-Larkin, Tsai & Carstensen, 2009), it was expected there would be no effect on positive specific recall, but an increase in negative specific recall in MemFlex participants relative to controls, which would be related to improvement in cognitive flexibility. Training negative specific recall remains important since over-generalisation of negative memories (and reduced access to specific memories) can lead to depressive symptoms such as rumination (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996; Raes et al., 2006). Furthermore, since cognitive flexibility is integral to specific recall it was hypothesised that MemFlex would benefit people with lower baseline cognitive flexibility the most.

Lastly, the target population’s perceptions of an intervention in terms of how effective they find it to be, how appropriate it is in addressing the kind of difficulties they experience, and the practicality of taking part will ultimately determine adherence to an

intervention and motivation to incorporate the skills learned into their everyday life. Therefore, through qualitative analysis of participants' feedback, a final aim was to examine acceptability of MemFlex in a non-depressed older adult population.

2.2.Methods:

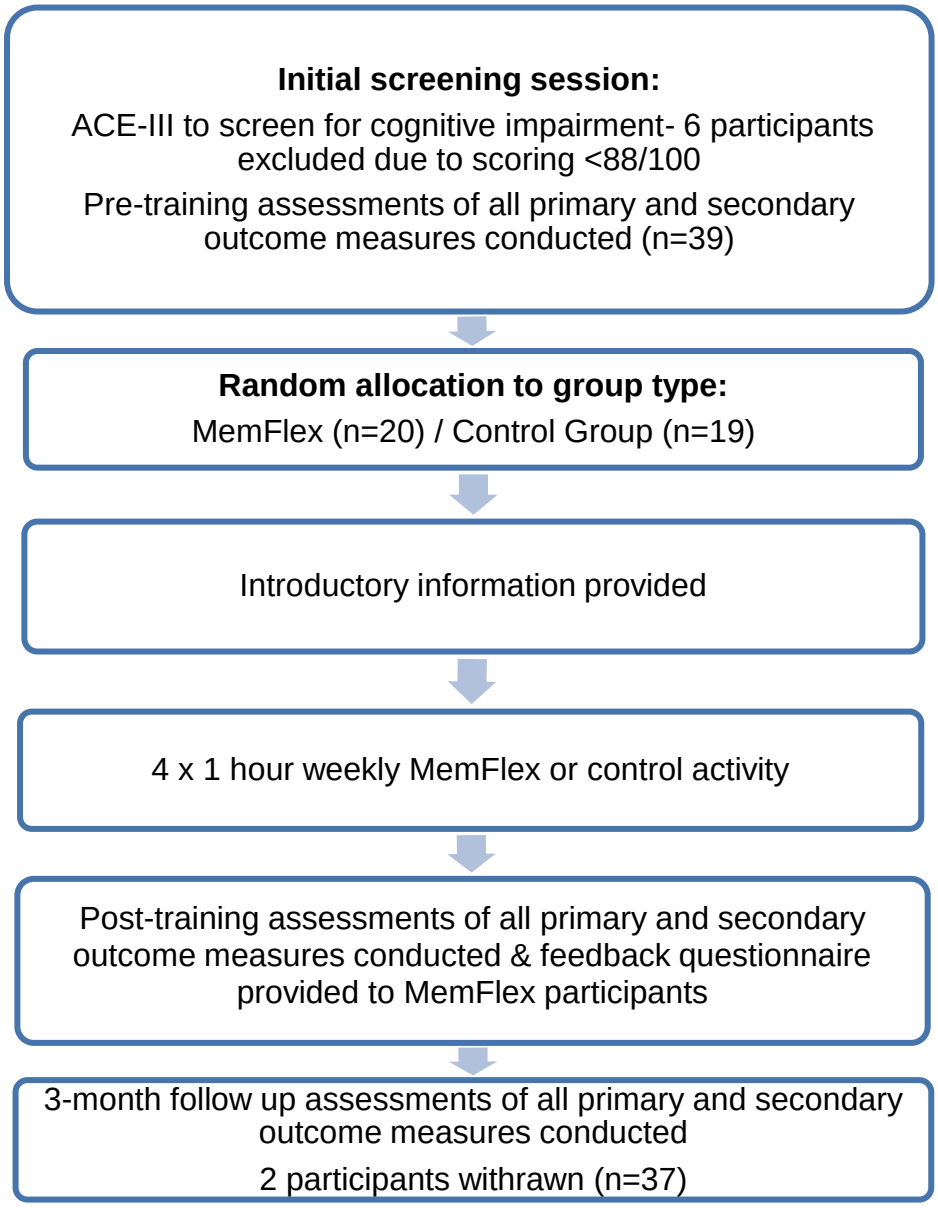
2.2.1.Participants:

Thirty-nine independently living older adults (aged 70+) took part (MemFlex, *n*=20; Control, *n*=19). See Table 2.1 for participant demographics of the sample after exclusions. Participants were recruited via a panel of volunteers who had agreed to be contacted by the University about healthy ageing research and through advertisement in the community. Participants were excluded if they were aged < 70 or had a diagnosis of a memory problem (including stroke, early dementia, or traumatic brain injury). Six participants who scored <88 on the ACE-III cognitive assessment (Noone, 2015) were excluded due to potential cognitive impairment. One control group participant was uncontactable after the post-training follow-up. Another from the MemFlex group withdrew due to unrelated health problems before completing the 3-month follow-up (See Figure 2.1 for flow chart of the study procedure). Pre-and post-training data only for these two participants were included in the analysis, therefore the sample size at 3-month follow-up data was 37 (MemFlex=19; Controls= 18). Participants who attended the University were reimbursed £7.50 per session for travel costs, and home visits were offered to include those who were less mobile or lived further from the University. Ethical approval was obtained from the University Ethics Committee, #709, with written informed consent being obtained from all participants.

Table 2.1. Participant demographics after exclusions across group type

		MemFlex group (n=20)	Control group (n=19)	Statistic	p value
Age	**Mean**	76.85	74.26	F=2.49	0.12
	SD	5.27	4.95		
Age when left education	**Mean**	17.75	19.68	F=3.77	0.06
	SD	2.65	3.53		
Gender (% within group type)	**Female**	70	52.6	X^2=1.24	0.27
	Male	30	47.4		
ACE-III at baseline	**Mean**	94.2	95.58	F=2.38	0.13
	SD	2.82	2.76		

Figure 2.1. Flow chart of study procedure



2.2.2.Materials:

Primary outcomes:

Cognitive flexibility: The verbal fluency sub-score of Addenbrooke's Cognitive Examination-III (ACE-III; Hsieh, Schubert, Hoon, Mioshi & Hodges, 2013) measured the inhibition and initiation elements of cognitive flexibility, providing a combined

phonemic and category fluency score (0-14). The Random Number Generation task (RNG; Towse & Neil, 1998) also provided a measure of cognitive flexibility. The task involved participants calling random numbers from 1-9 in time with a metronome set at 1 beat per second for 1 minute. It provides a redundancy (R) score of how frequently each digit occurred as a measure of updating ability, and two measures of inhibition; an RNG index of how frequently pairs or triplets of digits occurred and an adjacency (combined) score indicating the occurrence of sequences of digits. Lower scores on each indicated a higher level of randomness.

Autobiographical memory specificity: In the Autobiographical Memory Task (AMT; Williams & Broadbent, 1986; Dalgleish et al., 2007) ten emotional cue words were read aloud and participants were asked to recall a specific memory in response to each. The same set of ten cue words was used for all participants within each stage, with a different set being used at each time point (pre-training, post-training and 3-month follow-up). Five of the words were positive and five were negative (see Appendix 4), presented in an alternating order. A pilot study conducted with twelve undergraduate students found that the three sets of cue words (Set 1, M=0.64, SD=0.27; Set 2, M=0.53, SD=0.32; Set 3, M=0.64, SD=0.18) did not differ in terms of proportion of specific memories recalled, $F(2,20)=0.49$, $p=.62$, indicating that the words were matched in their potential to evoke a specific memory. Instructions were given to recall a memory of a specific event that lasted less than one day, and was on one particular occasion. Examples of correct (i.e. a specific memory) and incorrect responses (i.e. a non-specific memory) were given and participants completed a practice trial before beginning the task.

Audio recordings of participants' responses were taken to be coded later. Memories of events that lasted less than a day and that occurred on one particular occasion were coded as specific. Memories that lasted longer than a day or were repeated events (e.g. "My holiday in Spain" or "Going to the beach") were coded as overgeneral. If the type of memory recalled was unclear, or if the response was not a memory (e.g. it was an opinion related to the cue) participants were prompted (e.g. "Was that on one particular occasion?" or "Can you think of a memory in relation to that?"). The first rateable memory was scored as specific, general, or if no memory was given the response was scored as omission. If the participant failed to respond within 1 minute, the response was also coded as omission. The total score was the proportion of specific memories retrieved out of all ten cue words presented (0-1). Separate scores for positive and negative specific recall were also calculated by taking the proportion of

specific memories recalled out of all five of each cue valence (0-1). A random sample of 60 memories (30 from the MemFlex group and 30 from the control) was rated by an independent rater who was blind to group type. Inter-rater reliability for specific vs general was calculated as Cohen's Kappa=0.74 with a percentage agreement of 95%. Cohen's Kappa was selected as a measure of inter-rater reliability for the AMT because it is appropriate for nominal data. Categorisation of memories recalled on the AMT results in nominal data, i.e. there is no 'true zero' but rather two categories: specific or general.

Secondary Outcomes:

Social problem-solving ability: In the Means End Problem-Solving Procedure (MEPS; Platt & Spivack, 1975; see Appendix 1) participants were asked to describe how they would solve a series of four hypothetical social problem scenarios. The problems included one's partner leaving them after an argument, having difficulties with one's boss, falling out with friends, or moving to a new neighbourhood. Two measures obtained; the mean "number of relevant steps/means" taken to solve the problem and the mean "effectiveness" rating of the solution from 0-7, higher scores indicating better social problem-solving. To assess inter-rater reliability, a random sample of 48 problem solutions (24 from the MemFlex group and 24 from the controls) was rated by an independent rater who was blind to group type. The intra-class correlation coefficient was .74 for number of relevant means, and .72 for effectiveness ratings. Intra-class correlation was selected as a measure of inter-rater reliability for the MEPS because it is appropriate for continuous data (i.e. ratings of the number of relevant means and effectiveness of the participants' responses).

Self-rated depression: The depression subscale of the Hospital Anxiety & Depression Scale (HADS; Zigmond & Snaith, 1983) was used in the current study to detect presence and severity of depression in the participant sample. The depression subscale of the HADS is a self-report measure that is comprised of 7 questions relating to different aspects of depression. Each item is scored from 0 – 3, thus possible scores on this measure range between 0 and 21, with higher scores indicating greater levels of depression. The cut-off scores are as follows; normal 0–7, mild 8–10, moderate 11–14, and severe 15–21 (Zigmond & Snaith, 1983). In a large population study, Mykletun, Stordal and Dahl (2001) confirmed that this is a reliable measure of depression (Cronbach's alpha of 0.76).

Independence: The instrumental & basic activities of daily living scales (IADL, ADL) (Lawton & Brody, 1969; Katz, Ford, Moskowitz, Jackson & Jaffe, 1963) provided total scores of independence (IADL; 0-8 & ADL; 0-6). The functional limitations profile (FLP; Pollard & Johnston, 2001) gave a total score (0-1150) and 10 sub-scores: walking and using stairs (0-126), body care or movement (0-124), mobility (0-114), household management (0-90), recreation (0-91), social (0-109), alertness (0-115), sleep (0-111), eating (0-143), and communication (0-127).

Interventions:

Memory Flexibility Programme (MemFlex) (Hitchcock et al., 2015):

Hitchcock et al's (2015) MemFlex intervention in younger depressed adults aimed to reduce depressive symptoms by targeting maladaptive cognitive patterns, such as reduced cognitive flexibility and a bias towards negative material (Gotlib & Joormann, 2010; Williams et al, 2007). In younger depressed samples, MemFlex has been found to have medium sized effects on improving AMS and problem-solving in an uncontrolled trial (Hitchcock et al, 2016), and small-moderate effect sizes on improving memory flexibility and reduction of depression compared to a psychoeducation control group (Hitchock et al, 2018). The programme is based on a combination of cognitive bias modification treatment, which aims to reduce attentional bias towards negative material, and memory specificity training (MEST; Raes et al., 2009), which aims to improve specific memory recall through systematic practice. MemFlex has three main aims: 1) to balance between positive and negative memories in order to reduce cognitive bias; 2) to elaborate on positive memories to improve their quality and thus their use for emotion regulation; 3) to improve flexibility of memory retrieval, i.e. to selectively switch between general and specific, and positive and negative memories.

The MemFlex workbook activities in the current study were the same as those used by Hitchcock et al (2015), however, the wording was adapted for use with a non-depressed older adult population. For example, in information relating to depression, the word "depression" was replaced with the words "low mood" and the word "therapist" altered to "researcher". The intervention consisted of a face-to-face introductory session with the researcher, followed by eight self-guided sessions which participants completed at home. In the introductory session the researcher provided a brief outline of different memory systems (i.e. working memory, long term memory and autobiographical specificity) and how they are affected by ageing, age-related deficits in AMS, the relationship between AM and mood, and the importance of AM in everyday

life. Examples were provided and participants were given a chance to practice to ensure they had understood before receiving the workbook to complete at home over 4 weeks. A diary sheet was provided at the start of the workbook to help participants plan the sessions around their schedule. The workbook was organised as per the protocol used by Hitchcock et al (2015). A summary of the tasks in each session is provided in Table 2.2 (see Hitchcock et al., 2015 for a full description).

Table 2.2. Summary of the tasks in each session

Session 1	Overview of introductory information and six specific cue word tasks
Session 2	Six specific retrieval tasks (four cue word, one picture cue, and one scenario cue) plus elaboration on the details of the memories
Session 3	Five general cue word tasks
Session 4	Four specific and four general cue word tasks in alternating order
Session 5	Three cue words requiring retrieval of a general theme memory followed by two related specific memories.
Session 6	Two cue words requiring retrieval of two specific events followed by a related general theme memory.
Session 7	Three hypothetical situations requiring participants to select whether a specific, general or both types of memory would be helpful
Session 8	Three tasks (word, scenario, picture) requiring retrieval of a specific event memory and elaboration on the details of this, followed by a related general theme memory, followed by several specific related events.

Control workbook:

Participants in the control condition were similarly asked to complete a healthy ageing workbook at home over four weeks. This was to enable a comparison to the MemFlex workbook by providing education about healthy ageing, therefore promoting a positive lifestyle and maintaining wellbeing, but without specifically influencing memory retrieval. This is consistent with the protocol of Hitchcock et al (2015) as our control workbook also consisted of eight self-guided sessions (two per week). Each session of our healthy ageing book provided reading material (taken from www.ageuk.org.uk) about an age-related health topic (e.g. mental wellbeing, staying physically active, healthy eating) followed by a series of questions about the material, or activities related

to the topic to ensure participant engagement. There was also a diary sheet to help schedule sessions, as in the MemFlex workbook.

Feedback questionnaire:

An optional, anonymous feedback questionnaire was provided to MemFlex participants following the post-training session (see Appendix 3). The questionnaire consisted of seven open-ended questions about the training such as “Did you feel you benefitted in any way from taking part in the training programme, and if so, how?” The responses on the forms were analysed using the thematic analysis method suggested by Braun and Clarke (2006) in order to analyse and interpret participants’ experiences of MemFlex.

2.2.3.Procedure:

Pre-training assessments were conducted in an initial screening session. Following exclusion of participants who did not meet inclusion criteria, participants were randomly allocated between the MemFlex or control group. Random allocation to a condition was conducted in blocks using computer-generated random numbers. The ratio of participants allocated to a condition was adjusted to 2:1 (MemFlex: Control) in later blocks to balance group sizes as three participants from the MemFlex group had withdrawn before completing post-training, resulting in a disproportionate sample size compared to the control. Following random allocation participants completed the intervention/ control workbooks over the course of 4 weeks. In the week following the last intervention/ control session, participants completed post-training assessments. The MemFlex group were also asked to complete the feedback questionnaire. Finally, all participants then completed a 3-month follow-up assessment. Those in the control group were offered the chance to complete an AM intervention workbook (based on MEST) at the end of the study.

2.3.Results:

Participant characteristics:

Independent t-tests on pre-training scores revealed no significant differences between groups in demographics (see Table 2.1) or the following variables of interest: AMT scores; depression ratings; social problem-solving; or cognitive flexibility, $p>.1$ (see Table 2.3). There was, however, a significant difference in total score on the functional limitations profile (FLP) at baseline, $t(37)=2.96$, $p=.005$, with more functional limitations

in the MemFlex group than controls (see Table 2.3 for means). Further comparisons between the FLP subscales revealed that the only two subscales where the groups differed were related to physical health; i.e. walking and using stairs (MemFlex, M=40.5, SD=34.14; Control, M=17.05, SD=27.61); t(37)=2.35,p=0.024, body care or movement (MemFlex, M=48.2, SD=33.05; Control, M=18.68, SD=32.85); t(37)=2.8, p=0.008. There were no significant differences between groups on any other FLP subscale, p>.05.

Ceiling/floor effects:

There were ceiling effects on the ADL and IADL measures, with 92.3% scoring equal to or above 5 out of 6 on the ADL measure, and 100% scoring 8 out of 8 on the IADL measure at baseline.

The lowest score on the FLP was 43 and the highest was 692, giving a range of 649. 71.8% scored below 324.5, which is the halfway point of this range.

A floor effect was observed with 61.5% of the sample scoring below 3 out of 21 on the HADS depression rating scale at baseline. None of the participants scored above the recommended cut-off for mild depression (8 out of 21; Zigmond & Snaith, 1983) at baseline, post-intervention or 3-month follow up.

Adherence to intervention:

As some of the workbook activities were left blank, the proportion of workbook sessions completed were calculated for each participant: MemFlex workbook, *M*=0.85, *SD*=0.23; control workbook, *M*= 0.97, *SD*=0.12. An independent t-test revealed there was no significant difference between groups in proportion of workbook completed, p>0.05.

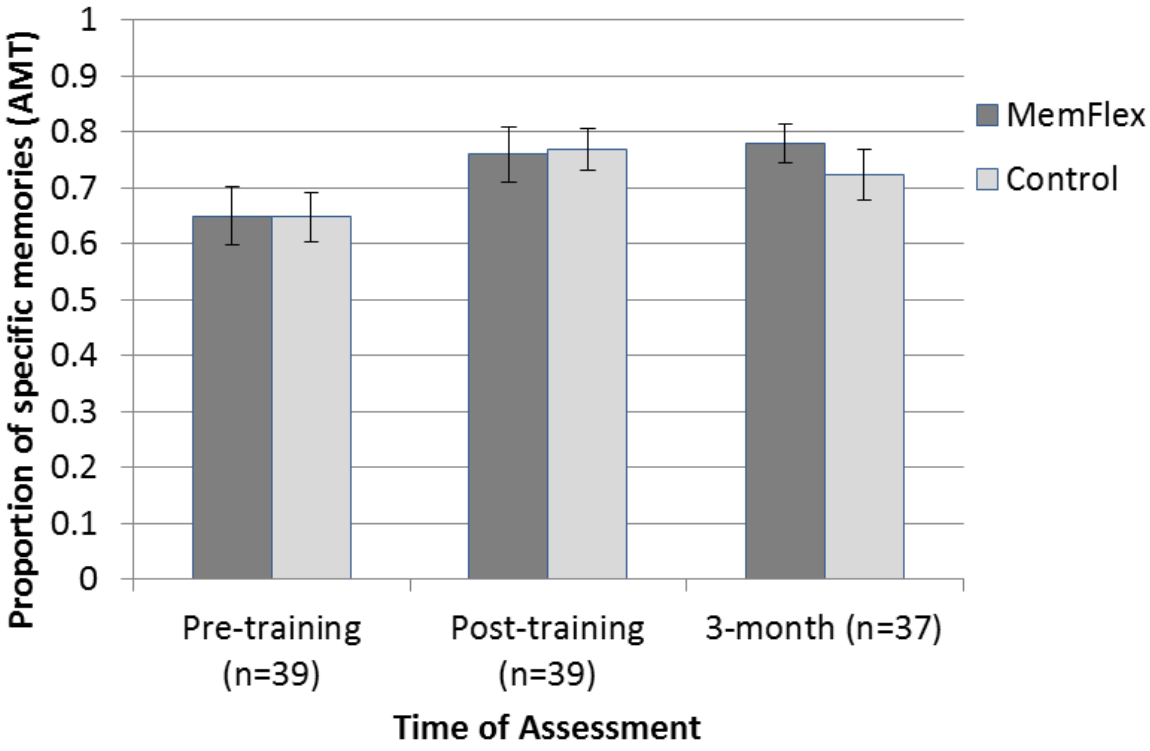
Primary outcomes:

The proportion of specific memories recalled on the AMT (AMT-pS) and scores on the cognitive flexibility measures were analysed using 2 (MemFlex vs. Control) x 3 (Pre, Post, Follow-up) ANOVA in order to test the hypothesis that the MemFlex group would exhibit improvements in AMS and cognitive flexibility, relative to the control group.

Autobiographical memory specificity:

A significant main effect of time on AMT-pS showed that AMT scores improved over time regardless of group type, $F(2,70)= 6.42$, $p=0.003$, partial eta squared (ηp^2)=0.16. A significant linear contrast was observed, $F(1,35)=6.91$, $p=0.013$, $\eta p^2=0.17$, as well as a significant quadratic contrast $F(1,35)=5.66$, $p=0.023$, $\eta p^2=0.14$ (see Figure 2.2). The mean values (see Table 2.3) suggest that whilst AMT-pS increased linearly in the MemFlex group across the three time points, there was a curvilinear relationship in the control group with mean AMT-pS increasing at post-training, and decreasing slightly at the 3-month follow-up. However, there was no significant interaction between time and group type, $p>0.1$. Therefore, the hypothesis that there would be an improvement in AMS in MemFlex participants relative to controls was thus unsupported.

Figure 2.2. Proportion of specific memories recalled at each time point in each group. Error bars represent +/- 1 standard error of the mean.



Cognitive flexibility:

There were no significant main effects or interactions on the RNG index or the redundancy (R) score, $p>0.1$. On the adjacency (combined) score there was a main effect of time, $F(2,70)=6.86$, $p=0.002$, $\eta p^2=0.16$, with a significant linear contrast

observed $F(1,35)=10.77$, $p=0.002$, $\eta p^2=0.24$, showing that overall scores decreased (indicating an improvement) across time. However, there was no group x time interaction, $p>0.1$. There were no significant group type x time interactions on the verbal fluency task, $p>0.1$. The hypothesis that there would be improvements in these measures in MemFlex participants relative to controls was thus unsupported.

Table 2.3. Means and standard deviations of all relevant variables at pre-training, post-training and 3-month follow-up.

		Pre-training mean (SD)		Group difference at baseline		Post-training mean (SD)		2 (time) x 2 (group) interaction		3-month mean (SD)		3 (time) x 2 (group) interaction	
Variable		**MemFlex (n=20)**	**Control (n=19)**	***F* value**	***P* value**	**MemFlex (n=20)**	**Control (n=19)**	***F* value**	***p* value**	**MemFlex (n=19)**	**Control (n=18)**	***F* value**	***p* value**
AMT-pS		0.65 (0.23)	0.65 (0.19)	0.002	0.969	0.76 (0.22)	0.77 (0.16)	0.023	0.88	0.78 (0.15)	0.72 (0.19)	0.43	0.65
AMT Positive-pS		0.66 (0.28)	0.67 (0.21)	0.03	0.864	0.72 (0.26)	0.77 (0.2)	0.115	0.74	0.76 (0.21)	0.79 (0.21)	0	1
AMT Negative-pS		0.64 (0.27)	0.62 (0.23)	0.55	0.816	0.8 (0.19)	0.77 (0.19)	0.023	0.88	0.8 (0.21)	0.66 (0.26)	1.3	0.28
Cognitive Flexibility	**Verbal Fluency**	12.2 (1.4)	12.37 (1.34)	0.147	0.704	12.55 (1.1)	12.68 (1.67)	0.005	0.95	12.63 (1.3)	12.67 (1.19)	0.04	0.96
	RNG	0.26 (0.04)	0.27 (0.07)	0.848	0.363	0.28 (0.06)	0.25 (0.04)	3.898	0.06	0.27 (0.07)	0.26 (0.06)	1.4	0.25
	R	1.66 (1.75)	1.44 (0.69)	0.267	0.609	1.44 (0.8)	2.03 (1.21)	3.193	0.08	1.71 (1.25)	1.97 (1.08)	1.62	0.21
	Adjacency (combined)	28.9 (10.13)	29 (10.05)	0.001	0.975	28.33 (10.2)	22.86 (10.24)	3.411	0.07	24.09 (10.29)	21.85 (9.58)	2.11	0.13
MEPS	**No. Relevant means**	3.68 (0.83)	3.67 (1.16)	<0.001	0.99	3.93 (0.94)	3.49 (1.04)	4.735*	0.04	3.63 (0.86)	3.6 (0.9)	2.88	0.06
	Effectiveness (0-7)	3.7 (1.05)	3.77 (1.41)	0.031	0.861	3.69 (1.16)	3.74 (1.45)	0.006	0.94	3.68 (1.11)	3.76 (1.25)	0.21	0.81
HADS Depression (0-21)		3.38 (2.16)	2.79 (2.02)	0.765	0.387	3.25 (2.1)	2.63 (2.06)	0.004	0.95	2.89 (2.31)	2.22 (2.05)	0.04	0.96
ADL (0-6)		5.9 (0.31)	5.95 (0.23)	0.294	0.591	5.9 (0.31)	5.95 (0.23)	<0.001	1	5.89 (0.32)	5.94 (0.24)	<0.001	1
IADL (0-8)		8 (0)	8 (0)	.	.	8 (0)	8 (0)	.	.	8 (0)	8 (0)	.	.
FLP	**Total (0-1150)**	334.7 (136.89)	199.58 (148.51)	8.741*	0.005	329.85 (129.17)	219.63 (176.58)	0.476	0.5	342.16 (176.3)	222.56 (162.35)	0.17	0.84

Relationship between changes in primary outcomes:

Change scores were calculated for cognitive flexibility and AMT-pS by taking the difference between scores at 3-months and pre-training. Correlational analyses were performed in order to examine the hypothesis that changes in these two primary outcomes would be positively correlated. There was no correlation between change in any of the cognitive flexibility measures and change in AMS-pS, $p>0.1$, thus the hypothesis was unsupported.

Positive vs negative AMS:

Repeated measures ANOVA showed no differences between the proportion of specific memories recalled for positive cues (AMT Positive-pS) and for negative cues (AMT Negative-pS) at any of the time points in the whole sample, $p>0.1$, therefore the hypothesis that there would be a bias towards recalling positive specific memories compared to negative specific memories was unsupported.

Two 2 (MemFlex vs. Control) x 3 (Pre, Post, Follow-up) ANOVA were conducted with AMT Positive-pS and AMT Negative-pS as dependent variables separately in order to test the hypothesis that there would be an increase in negative specific recall in the MemFlex group relative to controls, but no effect on positive specific recall. There was a marginal effect of time on AMT positive-pS, $F(2,70)= 2.86$, $p=0.064$. Although the overall effect of time was not significant, there was a significant linear contrast, $F(1,35)= 4.37$, $p=0.044$, $\eta p^2=0.11$ showing that scores increased overall. However, there was no interaction with group type, $p>0.1$. There was a significant effect of time on AMT Negative-pS, $F(2,70)= 6.37$, $p=0.003$, $\eta p^2=0.15$ with marginal linear, $F(1,35)=4.02$, $p=0.053$, $\eta p^2=0.1$ and significant quadratic contrasts, $F(1,35)=9.63$, $p=0.004$, $\eta p^2=0.22$. There was no interaction with group type, $p>0.1$. The main effects of time support the hypothesis that there would be an increase in negative, but not positive specific recall. However, the lack of interaction with group type suggests this was a practice effect.

The mean values (see Table 2.3) suggest that whilst AMT Negative-pS increased linearly in the MemFlex group and then remained stable there was a curvilinear relationship in the control group. Pairwise comparisons confirmed that there was a significant increase in AMT Negative-pS in the MemFlex group from pre-training to both post-training, $t(19)= -3.56$, $p=0.002$, and 3-month follow-up $t(18)= -2.7$, $p=0.015$. There

was only a marginally significant increase from pre- to post-training in the control group, $t(18)= -2.06$, $p=0.054$, but not from pre- to 3-month follow-up, $p>0.1$. There were no significant increases in AMT Positive-pS in either group, $p>0.05$. One-way ANOVAs showed no significant differences between the groups at pre-training, post-training or 3-month follow-up in either AMT Negative or Positive pS, $p>0.05$. This provides some support for the hypothesis that there would be an increase in negative specific recall in the MemFlex group relative to controls, but no effect on positive specific recall.

Cognitive flexibility and changes in affective bias:

Change scores for AMT Positive-pS AMT Negative-pS and cognitive flexibility measures were calculated by taking the difference between scores at 3-month and pre-training in order to examine the hypothesis that improvement in cognitive flexibility would be related to an increase in negative specific recall, but not in positive specific recall. Correlational analysis revealed no significant relationships between any change variables, $p>0.1$, thus the hypothesised relationship between increase in negative specific recall and improvement in cognitive flexibility was unsupported.

Baseline cognitive flexibility and changes in AMS:

Relationships between baseline cognitive flexibility measures and change scores for total AMT-pS, AMT Positive-pS and Negative-pS were examined in order to test the hypothesis that MemFlex would be particularly helpful for people with lower baseline cognitive flexibility. There were no relationships between these variables in the MemFlex group alone. Since there was a main effect of time in AMT-pS in the whole sample, these relationships with the whole sample were further examined. Adjacency (combined) score at pre-training was positively correlated with both overall change in AMT-pS, $r=0.34$, $p=0.038$, and change in AMT Negative-pS, $r=0.38$, $p=0.019$, but not change in AMT Positive-pS, $p>0.1$. As reported earlier, there were significant improvements in overall AMT-pS and in AMT Negative-pS in the whole sample. This suggests that in the whole sample, people with the highest adjacency scores (i.e. lowest inhibition ability) had the biggest improvements in recall of specific memories, particularly negative memories. This supports the hypothesis that lower baseline cognitive flexibility would be positively related to change in AMS, however this was only true for negative memories.

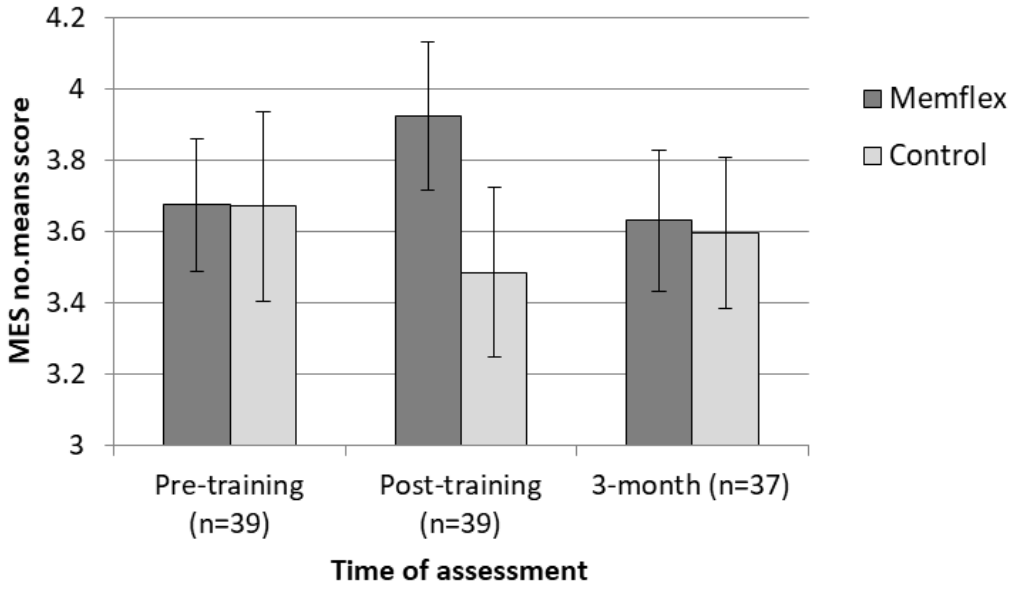
Analysis of secondary outcomes:

Mixed 2 (Group type; MemFlex vs. Control) x 3 (Time; Pre, Post, Follow-up) ANOVA were conducted separately with each of the secondary outcome measures as dependent variables in order to test the hypothesis that MemFlex participants would exhibit improvements on secondary outcome measures, relative to controls.

Social problem-solving:

There were no significant main effects of group or time (p>0.1) but there was a marginal group x time interaction in the number of means generated on the MEPS task, $F(2, 70)= 2.88$, p=0.063. There was a significant quadratic contrast for the interaction between time and group type, $F(1,35)=8.43$, p=0.006. The mean values (see Table 2.3) suggest that whilst MEPS number of means increased from pre-training to post-training, and decreased from post-training to 3-month follow up in the MemFlex group, in the control group these scores decreased from pre-training to post-training, and then increased from post-training to 3-month follow up (see Figure 2.3). There were no main effects and no interactions on the effectiveness ratings on the MEPS task, p>0.1.

Figure 2.3. Number of relevant means on the MEPS task at each time point in each group. Error bars represent +/- 1 standard error of the mean.



Depression:

There were no main effects or group x time interaction on HADS depression ratings, p>0.1.

Independence:

Since there was a group difference at pre-training in functional limitations, ANCOVA was conducted to examine group effects at post-training whilst controlling for pre-training scores on the FLP, however there was no effect of group type, $p>0.1$. There were no group x time interactions on any of the FLP subscales, or on the ADL or IADL measures.

Overall, the hypothesis that the MemFlex participants would exhibit improvements on secondary outcome measures relative to controls was unsupported.

Relationships between changes in AMS and secondary measures:

Correlations were conducted to test the hypothesis that changes in secondary outcomes would be positively related to changes in AMS. There was a significant positive correlation between change in AMT-pS and change in MEPS number of means $r=0.39$, $p=0.016$, with change in AMS being positively related to change in social problem-solving ability. There were no other significant correlations between change in AMT-pS and change in any of the other variables, $p>0.05$. However, after correcting for multiple comparisons using Bonferroni this was no longer significant.

2.3.1.Qualitative analysis of feedback questionnaire to assess acceptability:

Four participants withdrew from the MemFlex condition due to difficulty understanding the workbook and completing the activities. One other participant who did complete the intervention commented on the feedback questionnaire that the language was difficult to understand:

> "*I had to study instructions and introductory sections of the workbook very carefully, reading them several times before attempting the tasks. I think it's mainly about switching on to the often abstract vocabulary, i.e. getting on the 'wavelength'.*"

However, regardless of this the same participant also commented in the feedback form that he did enjoy the programme overall and said "the tasks were not over burdensome".

Feedback forms were returned anonymously by twelve participants out of the twenty who took part in the MemFlex intervention. Thematic analysis resulted in two key themes; benefits/outcomes of intervention, and overall enjoyment of intervention.

Benefits/outcomes of intervention:

Two participants answered "No" to the question "Did you feel you benefitted in any way from taking part in the training programme, and if so, how?" but did not expand on their answers any further. The remaining ten participants reported positive outcomes, even if they were not sure whether they had actually benefitted from the training in terms of improving their memory. The outcomes reported were: helped recognise that their memory was not as bad as they thought; increased understanding of why memory difficulties occur; received interesting and stimulating activity; and enjoyed the experience of recalling memories from the past. For example:

> *"Yes, the retrieval parts were important to me. It helped me to realise that maybe my overall image of my memory were not as bad as I imagined."*
>
> *"For me in particular it helped me to understand that I do have a momentary blank when I am feeling some stress."*
>
> *"I'm not sure whether I benefitted from the training programme, but I enjoyed it and found it interesting." "Any mental activity must help as one ages."*

Overall enjoyment of the intervention:

Participants commented that recalling memories of past events was a positive, enjoyable experience. The programme gave them the opportunity to recall memories that they may not have thought about for a long time because they had not previously had any reason to recall them, therefore the workbook gave them a platform to recall old memories.

> *"Yes, made me remember lots that I thought I had forgotten"*
>
> *"It did drag up memories I had forgotten about, which was quite refreshing"*

2.4.Discussion:

It was hypothesised that cognitive flexibility and autobiographical memory specificity (AMS) would both improve in the MemFlex group relative to controls. The findings show an improvement in AMS and the inhibition aspect of cognitive flexibility (indicated by decreased adjacency scores) across time in the whole sample. However, there was no interaction with group type thus these improvements were not higher in the MemFlex group than in controls. The lack of interaction suggests improvements may be due to other factors independent of the training, such as the benefit of simply receiving mental stimulation. It could also be due to practice effects as a result of participants (in both MemFlex and control groups) completing the AMT and RNG task on multiple occasions. The qualitative analysis supports this as participants felt that completing the MemFlex workbook was generally stimulating and a positive experience, but may not have had specific effects on their memory.

The overall improvement in AMS across time suggests that AM specificity is a modifiable cognitive skill, and thus over-general memory (OGM) commonly found in older populations (Holland et al, 2012; Ros, Latorre, & Serrano, 2010; Piolino, Desgranges, Benali & Eustache, 2002) is amenable to change. This is important as higher AM specificity has been related to better mental wellbeing in non-depressed older populations (Latorre et al., 2013). Furthermore, previous studies with depressed younger adults have indicated that memory specificity training has positive effects on reducing OGM and reducing depressive symptoms (Raes et al., 2009; Neshat Doost et al., 2013; Moradi et al., 2014). However, this is the first study to test MemFlex with a population who are both older and non-depressed. MemFlex was originally designed for younger, depressed adults, to target maladaptive cognitive patterns such as a bias towards negative material. Therefore, it may be that the lack of expected effects were due to the target population not showing the same cognitive biases, i.e. older adults did not have a negative bias. In addition, Burns (2014) found that the executive process of "shifting" (i.e. ability to flexibly shift between multiple tasks) accounted for the relationship between OGM and depression in a clinical sample of older adults, which is in contrast to findings of a lack of relationship between shifting and OGM in healthy older adults (Piolino et al, 2010). This implies that in addition to any interaction between general ageing and OGM, the executive process of shifting plays an extra role in depressed populations (Burns, 2014). Whilst cognitive flexibility deficits associated with depression may explain reduced AMS in depressed populations, age-related cognitive flexibility deficits may not be sufficient to explain the effect of age on AMS.

The social context of the training may also be of relevance. MEST has mainly been conducted in small groups of participants (Raes et al., 2009), whereas in the current study MemFlex and control groups completed a workbook at home. Therefore, it may be that the lack of an effect of the MemFlex workbook on AMS in the current study was due to participants only receiving minimum feedback, encouragement and support in practising the cued recall tasks. The qualitative findings support this as one of the reasons participants withdrew was due to difficulty comprehending the workbook. This could potentially be overcome by receiving more help and guidance throughout each session in a face-to-face setting. This also emphasises the need for a comparison between AMS training studies and a matched control group who receive a similar level of group contact, as previous studies have also used a minimal contact control (Neshat Doost et al., 2013; Moradi et al., 2014).

The control workbook used in the current study was different from the control workbook in the original MemFlex study. Both workbooks included psychoeducation, but in the previous study, this was about depression, whereas in the current study it was about healthy ageing. Therefore, one potential explanation for the lack of expected difference in AMS between the groups post training is that the control workbook might have improved AMS by promoting wellbeing. For example, the healthy ageing workbook highlighted the importance of staying physically fit and socially active, both of which are associated with higher cognitive function in old age (Bennett et al, 2006; Kramer, et al., 2002).

Alea and Bluck's (2003) conceptual model of the social functions of AM highlights how recalling personal memories often occurs in social contexts in everyday life and therefore the actual process of sharing AMs with others, rather than just thinking about them to oneself and writing them down in a workbook, may be relevant in studies examining the functional aspects of AM. Individuals also collaborate and co-construct memories with others (Gould & Dixon, 1993; Edwards & Middleton, 1986), For example, in previous AM training studies participants may have benefitted from the sociable aspect, for example, in a group setting like in MEST (Raes et al, 2009). In a group setting, listening to other people's memories may help to prompt one's own memories, especially if they are people from a similar generation and therefore had similar era specific memories. Since memory is functional, it may be that there was an absence of contextual and social cues that typically would facilitate recall in daily life due to the format of the training, i.e. retrieving memories at home, and possibly alone. In support of this, one of the MemFlex participants commented that it was extremely

difficult to recall memories at home because she lived alone and had nobody to discuss, or possibly rehearse, memories with. Furthermore, Holland and Kensinger (2010) point out that verbal elaboration is an effective emotion regulation technique and that specific AM retrieval may involve similar processes. Perhaps verbalisation of the emotional details of specific AMs may be more useful for emotion regulation purposes.

The hypothesis that participants in the MemFlex group would exhibit improvements on secondary outcome measures relative to controls was also unsupported. There were no significant improvements in social problem-solving, independence, or depression measures. However, there was a significant quadratic contrast on MEPS number of means scores between time and group, with descriptive data suggesting this was due to a slight increase in MEPS scores from pre-training to post-training, and decrease from post-training to 3-month follow up in the MemFlex group, whilst in the control group these scores decreased from pre-training to post-training, and then increased from post-training to 3-month follow up. The increase at post-training in the MemFlex group is in line with the hypothesised improvement, and the decrease at 3-month follow up may be due to a simple reversion back to baseline. A larger sample might increase the power of this pattern. The lack of an effect on depression and independence could be explained by floor and ceiling effects as the sample had low depression ratings and high independence scores at baseline, therefore there was little room for improvement, unlike in the study by Holland et al (2016) where there was more variance in level of functional limitations. Given the encouraging findings with depressed younger adults, it may be useful for future studies to examine the effectiveness of MemFlex with a sample of clinically depressed older adults, since this population are likely to have more pronounced OGM at baseline and higher rates of depression, thus resulting in a greater potential for improvement.

However, change in AMS was related to change in social problem-solving. This correlation was not significant after correcting for multiple comparisons and therefore caution should be taken, although it is in line with previous findings of a relationship between these variables (Beaman et al., 2007), which supports the constructive episodic simulation hypothesis. This hypothesis states that the process of retrieving AMs is analogous to the process of generating solutions to social problems (Schacter & Addis, 2007; 2009). Previous research supports the suggestion that older adults' social problem-solving performance benefitted from brief training in recollecting details of past experiences (Madore & Schacter, 2014). This has implications for the maintenance of

wellbeing in later life since social functioning is essential to maintaining an active, engaged lifestyle.

There was no evidence for the hypothesised bias towards recalling specific positive memories compared to negative. However, in support of the hypothesis that there would be limited effects on positive compared to negative recall, there was a significant improvement in the whole sample in negative, but not positive, specific recall across time. The improvement in inhibition ability in the whole sample was not significantly related to the improvement in overall AMS, or to positive or negative AMS separately, therefore the hypothesis that increase in negative specific recall would be related to improvement in cognitive flexibility was unsupported.

It was, however, found that people with the highest adjacency scores (i.e. lowest inhibition ability) at baseline had the biggest improvements in specific recall. This improvement was particularly in relation to negative memories, therefore supporting the hypothesis that older adults may be protected from a detrimental impact of reduced cognitive flexibility on retrieving memories of a positive valence. This is in line with a previous finding that although executive function predicts overall specificity in older adults, it does not predict specific positive recall, suggesting that specific positive recall is not influenced by reduced executive control in older adults (Holland et al., 2012). This may be because preserved emotional processing in older adults provides an automatic route to specific positive memories, resulting in less demand on executive functions (Scheibe and Blanchard-Fields, 2009). Together with the overall practice effects, this suggests that people with lower inhibition improved more so in negative specificity because it required more practice in the generative search process of inhibiting general memories. On the other hand, positive memories were recalled automatically, bypassing executive function, thus not requiring practice. This is important because previous research has suggested that a lack of inhibition of general negative memories in order to access specific memories can lead to generalisation and negative rumination processes associated with depression (Williams et al., 2007). Thus, training the executive process of inhibiting general negative memories may be useful for reducing rumination in depressed older adults. This suggestion should be taken with caution because there was no effect on mood in the current study; however, participants in the current study were not clinically depressed.

It could be that training the inhibition element of flexibility in negative retrieval may only be useful for depression-related OGM, i.e. in those who are currently clinically depressed. This technique may, however, be less useful in non-depressed older adults

if positive specific recall is protected from the impact of age-related cognitive flexibility deficit on AMS. Previous AMS training with non-depressed older adults which focussed on specific positive AMs only has been effective at improving life satisfaction and reducing depression symptoms (Latorre et al., 2013). As Holland et al (2012) suggested, focussing on positive recall as a strategy may act as a buffer against OGM recall in healthy older adults. This study proposes that interventions for age-related OGM may benefit from targeting positive memories instead of the executive processes associated with negative generalisation, whilst the latter may be a more useful strategy for depressed older adults.

One limitation of the study was that the sample size was small, however it is larger than other studies which have found large effects on AMS (Heeren et al., 2009; Neshat Doost et al., 2013; Raes et al., 2009). The power was also sufficient to detect effects according to a power analysis conducted for a within-between interaction design with an effect size of f =0.3 (a large effect size), a power of 0.80, with a type 1 error rate α =0.05 which gave n=20 per group.

Another limitation was that the MemFlex group had significantly more functional limitations at baseline than did the controls. However, the group differences related to physical health; i.e. walking and using stairs, and body care or movement, which would be less likely to influence the effectiveness of the MemFlex intervention than would variations in cognitive limitations.

It is possible that the workbook was either too difficult for participants to complete or that the language used was hard to follow or understand. This was supported by the qualitative analysis as readability and comprehension was an issued raised by some, but not all of the participants. It may be useful for future studies to consider participant involvement in the development of the workbook questions, structure and language to ensure that it is suitable for an older adult population.

A final limitation is that we measured the executive functions which are regarded as underlying components of cognitive flexibility, such as updating, inhibition and initiation. Although the verbal fluency tasks are considered a broad measure of executive control and cognitive flexibility (e.g., Eslinger & Grattan, 1993), caution should be taken in generalising these functions to their use in specific AM retrieval. Future studies may wish to resolve this by employing a wider range of cognitive flexibility measures directly. For example, the Wisconsin card sorting task is often used as a measure of set shifting or flexibility as it requires participants to stop perseverating on one rule, e.g.

sort the cards by colour, and switch to a different rule, e.g. sort the cards by number. A direct measure of AM flexibility as opposed to just the proposed underlying benefit of cognitive flexibility to AMS would also be helpful in order to investigate whether ability to flexibly retrieve different types of AM was improved by MemFlex. For example, the AMT-AI (Dritschel et al, 2014) measure would inform us about any effect of MemFlex on switching between retrieving general memories when instructed, to retrieving specific memories when instructed, and vice versa.

Conclusion

In conclusion, the results showed that AMS and inhibition ability are amenable to change in older adults. Although there were no effects on secondary outcomes, there was a relationship between change in AMS and change in social problem-solving, supporting the usefulness of AMs to social functioning, which is critical to older adults' wellbeing. The finding that baseline lower inhibition ability was positively correlated with change in negative AMS supports the hypothesis that positive AMS may be an automatic process in older adults. It was proposed that whilst interventions for depression may benefit from practice in inhibiting general negative memories, in healthy older adults it may be more useful to focus on positive memory recall. Incorporating the sociable aspect of sharing memories with others into retrieval practice may also be helpful.

Chapter 3: Determining the mechanisms underlying life review and Memory Specificity Training (MEST)

3.1.Introduction:

As described in Chapter 1 the justification for developing interventions to improve autobiographical memory specificity (AMS) in older adults is based on evidence for AMS as an important factor in the preservation of mental health, social problem-solving and functional independence (Beaman, Pushkar, Etezadi, Bye, & Conway, 2007; Latorre et al., 2013; Holland et al., 2016). In the current chapter the influence of two autobiographical memory (AM) training methods on each of the above outcomes were examined in a sample of healthy older adults.

In order to develop interventions to reduce over-general memory as a preventive strategy in healthy, non-depressed older adults it is helpful to consider overlaps in the underlying mechanisms of depression-related and age-related over-general memory. The mechanisms underlying over-general memory in depression and trauma are clearly summarised by the CaR-FA-X model which highlights three processes that disrupt the retrieval process (Williams, 2006): Capture and Rumination on general negative material; Functional Avoidance of painful emotional material attached to specific negative events; and impaired executive function. In Chapter 2 the executive functions involved in cognitive flexibility were examined as potential underlying mechanisms of AMS. The results indicated that both AMS and the inhibition aspect of executive function are amenable to change in non-depressed older adults through practice, but there was no superior effect of the MemFlex intervention (Hitchcock et al, 2015) compared to a control activity. It was concluded that whilst cognitive flexibility deficits may explain reduced AMS in depression, age-related flexibility deficits may not be sufficient to explain the effect of age on AMS. Although there is evidence to show that age-related reduced executive control explains age-related OGM to some extent (as discussed in Section 1.3 of Chapter 1), there may also be other important factors underlying AM retrieval in non-depressed older adults to consider.

It is possible that the other two mechanisms of the CaRFaX model are also relevant in non-clinical age-related OGM. Ros, Latorre, Serrano & Ricarte (2017) examined all three mechanisms of the CaRFaX model in healthy older adults compared to younger adults and found differences between age groups in the CaRFaX functions that predict memory specificity. Older adults used less functional avoidance style strategies than younger adults, but lower functional avoidance was only related to better AMS in older

adults, not in younger adults. Older adults also performed worse on executive function tasks than younger adults, and higher executive function was related to better AMS in both age groups. There are also findings that older adults recruit cognitive control processes for the purpose of regulating emotion (i.e. remembering more positive than negative information; Mather & Knight [2005]), and for a relationship between executive function and functional avoidance (Ros et al., 2017). Ros et al (2017) proposed that together, these findings suggest that although older adults use less avoidant style strategies, they are more effective at using them to control negative affect. Thus, older adults are more efficient at using executive control to avoid the experience of negative emotions from negative AMs.

The above findings suggest that executive function is a key factor in OGM in healthy older adults, however, Ros et al (2017) did not separate positive and negative AMS in their analysis. It is possible that higher executive function relates to better positive recall but reduced negative recall because, as the authors suggest, executive control is required to cognitively avoid negative specific memories. It has previously been suggested that preserved emotional wellbeing in older adults is due to an enhanced focus on emotion regulation (Blanchard-Fields, 2007; Carstensen, 2006). This is in line with the socio-emotional selectivity theory which states that as people age they prioritise emotion regulation processes because the future is perceived as less open ended, therefore, they invest their resources in more emotionally gratifying goals. There is also a positivity effect in older adults' autobiographical memories (Mather & Carstensen, 2005), with older adults recalling memories as more positive in nature than younger adults (Kennedy, Mather and Carstensen, 2004). OGM has also been found to occur for neutral memories only in healthy older adults, whilst emotional specific memories are preserved (Holland, Ridout, Walford, & Geraghty, 2012). This is, again, assumed to be due to preserved emotional processing in later life. This supports Ros et al's (2017-page 28) suggestion that "future research should consider whether programs based on training in executive functions and positive emotional coping reduce OGM, and consequently, the risk of developing depressive disorders in older populations."

In addition, the findings of Chapter 2 revealed that people with lower baseline inhibition ability showed the biggest improvement in negative AMS through practice, supporting the suggestion that positive AMS may be an automatic process in older adults, bypassing executive function (Holland et al, 2012). This supports the suggestion that valence is an essential factor to consider in an older population, and that there may be

an interaction between valence and executive function in AM retrieval, i.e. lower executive function ability is linked to lower negative specific recall, but not positive specific recall. Therefore, in older adults focusing on executive processes may be helpful for improving access to specific negative memories, but not positive memories.

The aim of the current chapter was to tease apart the features of AM training methods that account for their effectiveness by examining two further interventions; one which provides systematic practice in the hierarchical process of retrieving specific AMs, which requires key executive processes such as inhibition and updating (i.e. Memory Specificity Training [MEST]), and one which focuses on enhancing positive specific memory recall only (i.e. life review). MEST has previously been successful at improving AMS in young depressed populations (Raes et al., 2009; Neshat-Doost et al., 2013), and in PTSD compared to treatment as usual (Moradi et al., 2014), whereas life review has been successful in older adult depressed and non-depressed populations (Serrano et al, 2004; Latorre et al, 2014). Raes et al.'s (2009) MEST is a standalone intervention consisting of repeated practice in recalling specific autobiographical memories in response to positive, negative and neutral cue words and sharing those memories within a group setting. Serrano et al.'s (2004) life review intervention incorporates traditional life review therapy with practice in specific AM recall. It is conducted one-to-one and participants are required to answer questions designed to prompt specific memories from different life periods (childhood, adolescence, adulthood, and a summary).

Memory Specificity Training (MEST; Raes et al. 2006):

MEST (Raes et al, 2006) was based on four proposed routes via which reduced AMS relates to depression: increased rumination, functional avoidance, impaired social problem-solving, and increased hopelessness resulting from a lack of ability to imagine future events. Although it is likely that improvements in executive function may be the mechanism underlying the observed increase in memory specificity following MEST, this has not yet been examined. As discussed above, impaired executive function is a key factor underlying both depression-related and age-related OGM (Dalgleish et al., 2007; Ros, Latorre, & Serrano 2010; Holland et al, 2012), therefore, assuming the underlying mechanism of MEST is a change in executive function, then it is plausible that MEST would have similar positive effects on memory specificity and mood in a non-depressed, older adult sample. Therefore, two aims of the current study were to determine if MEST can improve memory specificity and mood in older adults, and to

establish if improvements in memory specificity following MEST are related to concomitant changes in executive function.

Life review:

In contrast to the MEST programme, the life review programme (Serrano et al., 2004) was designed to prompt only positive memories, and not negative memories. Life review has broadly been defined as the structural evaluation of memories in order to form a positive, integrated view of one's past (Westerhof, Bohlmeijer, & Webster, 2010). Reminiscence-based interventions are commonly used in older adult populations and found to be beneficial for improving mood, example, Serrano et al (2004) found their life-review method helped to improved autobiographical memory specificity, increased life satisfaction scores, and reduced depressive symptoms compared to a control group (who received social services as usual) in a depressed sample of older adults. Importantly, the change in autobiographical memory specificity predicted the improvement in mood (Serrano et al, 2004). The beneficial effects of this life review programme which focus on positive AMs suggests that strengthening positive recall and reducing negative recall may be an important component of training in older adults. To date life review has mainly been used in samples of depressed older adults. Therefore, a further aim of the current chapter was to determine if life review could improve AMS as a standalone intervention in a sample of healthy non-depressed older adults.

Comparison of MEST and life review:

Raes et al (2009) argue that the cognitive-emotional processing of negative autobiographical memories during training is in line with theories of reduced autobiographical memory specificity in depression, i.e. impaired executive function or functional avoidance results in generalisation of, and rumination on negative memories, resulting in reduced access to specific memories. Alternatively, life review presents the opportunity for older adults to re-appraise events from their early life more positively, in light of this later bias, and this may be the mechanism that accounts for improvement in mood. Training negative specific recall may not be useful in this group due to enhanced emotional regulation with increasing age. To our knowledge, there has been no direct comparison between the mechanisms of different AM intervention strategies in a non-clinical sample of older adults. By comparing MEST and life review the current chapter aimed to tease apart the roles of executive function and valence in older adults' AM recall.

There are also some differences in the theoretical designs of the interventions, aside from in executive function and valence, which this chapter aimed to compare. For example, the beneficial effects of life review may be attributed to the focus on integration of specific memories within the context of one's whole life, as opposed to on systematic recall of specific memories as isolated events in the standalone MEST program.

The formats were also different as MEST was group-based whilst life review was delivered one-to-one. There are possible benefits to both, for example, the one-to-one setting is more confidential allowing recall of personal memories, whilst the group setting is more sociable and has better cost-benefit implications. Life review in a group format has also been found to improve self-esteem and life satisfaction in a non-clinical sample of older adults (Chiang, Lu, Chu, Chang, & Chou, 2008).

Aims & hypotheses:

The principal aim of the current study was to determine if MEST and/or life review interventions improve autobiographical memory specificity and mood in non-depressed older adults, relative to a control group who completed a workbook of cognitively stimulating activities. A further aim was to tease apart the features that make each intervention effective, including the focus on executive function and valence. A final aim was to investigate older adults' perceptions and experiences of the different methods through qualitative analysis of written feedback. The purpose of this was to determine which intervention was most acceptable to older adults, as this is likely to make the interventions more effective.

To these ends, a sample of older adults completed initial measures of mood, autobiographical memory specificity, social problem-solving, executive function and independence. Following baseline assessment, participants were randomly assigned to either an intervention (MEST or life review) or the control group (where participants completed a workbook). Participants completed the same measures again after four weeks of intervention (or control activity) and after three months.

It was hypothesised that immediately following training, participants in the intervention groups would exhibit improvements in autobiographical memory specificity and mood relative to the active control group.

Given that MEST has been shown to have long lasting effects on memory specificity

(Neshat-Doost et al., 2013; Moradi et al., 2014) it was predicted that, at 3-month follow up, participants in the MEST group would still exhibit superior memory specificity than controls. The long-term effects of life review were also examined (at 3 month follow up), but there were no formal hypothesis given that the long-term effects of life review on specificity have not been examined previously.

The influence of MEST and life review on social problem-solving ability or functional limitations has yet to be established. However, given that these key factors have previously been linked to autobiographical memory specificity (Beaman et al., 2007; Holland et al., 2016), it was hypothesised that, following training and at 3-month follow up, the intervention groups would exhibit improvements in social problem-solving and functional limitations relative to controls..

In terms of expected differences between the two interventions, it was expected that life review would have a stronger effect on mood, and that improved mood would be related to increased recall of specific positive events, rather than negative, due to the focus on positive appraisal. This is expected because the inclusion of specific negative recall in MEST is less relevant to this age group due to the positivity effect (Mather & Knight, 2005). It was also hypothesised that executive function would improve in the MEST group and would be related to increase in specificity. This is because MEST provides focused practice in the use of executive function to inhibit general memories and monitor the generative search process required to retrieve a specific memory. Since executive function is integral to the hierarchical search process it was expected that both methods would be particularly helpful for people with lower baseline executive function.

Examination of relationships between changes in key variables is expected to reveal that changes in mood, independence, and social problem-solving would be related to changes in specificity.

3.2.Method:

3.2.1.Participants:

Sixty six healthy participants aged 70+ took part in the study (MEST, *n*=22; Life review, *n*=22; Control, *n*=22). Demographic information for the sample after exclusions is displayed in Table 3.1. Participants were recruited via the same method as that described in Chapter 2, using the same exclusion criteria. In the current chapter, six

participants who scored <88 on the ACE-III cognitive assessment (Noone, 2015) were excluded due to potential cognitive impairment. Ethical approval was obtained from the University Ethics Committee, #709, with written informed consent being obtained from all participants. There were no significant differences between groups in demographics (see Table 3.1).

The MEST programme was set up first, followed by the life review program, which started 6 months later. Therefore, it was not possible to allocate participants at a ratio 1:1:1. Instead, participants were allocated at a ratio 1:1 to MEST: control, and then 1:1 life review: control. This meant that intervention type allocation depended on the time participants were recruited (i.e. those enrolled earlier: MEST or control, or those enrolled later: life review or control). Participants were unaware of this and there was no reason to suspect any differences across participants between recruitment stages. Nine participants from the control group withdrew from the study before reaching the post-training assessment stage. Therefore, the ratio of randomisation of participants was adjusted to 2:1 at this later point in order to ensure balanced sample sizes in each group.

The final sample consisted of 66 participants, however, 4 participants withdrew from the study due to illness before completing the 3-month follow up (1 from the MEST and 3 from the control group). This meant that only pre-and post-training data for these 4 participants were included in the analysis, therefore, the sample size of the 3-month follow up data (*N*=62) was slightly smaller (MEST=21; Life review=22; Controls= 19). One participant in the life review group could not attend the post-training assessment due to a family bereavement, but did attend the 3-month follow up, therefore, was retained in the study. However, this meant that sample size of the post-training data for the life review group was *n*=21. (See Figure 3.1 for flow chart of the study procedure).

Figure 3.1. Flow chart of study procedure

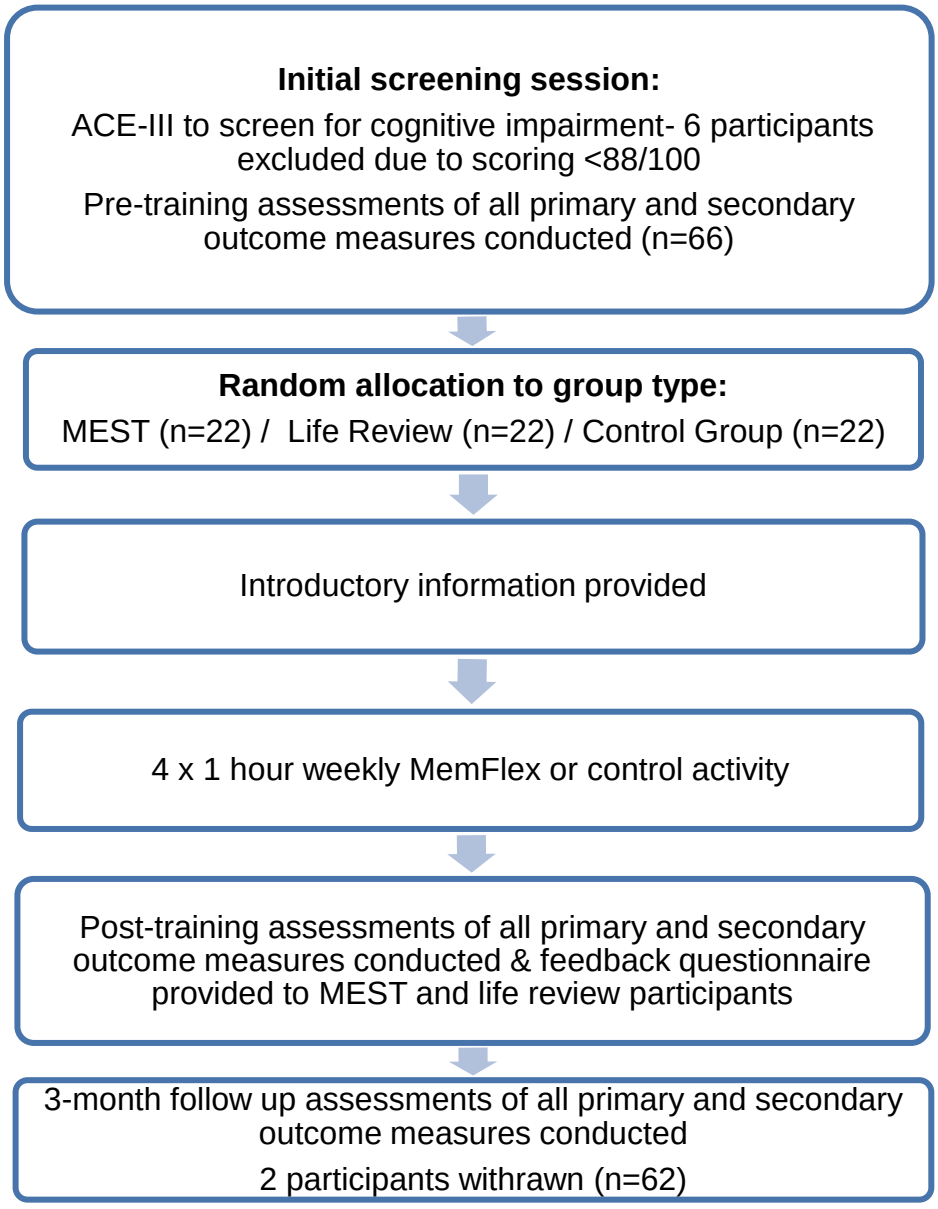


Table 3.1. Participant demographics after exclusions across group type.

		MEST (n=22)	Life review (n=22)	Control group (n=22)	Statistic	p value
Age	**Mean**	74.77	74.14	76.41	F=0.95	0.392
	SD	6.57	3.67	6.24		
No.Years in education	**Mean**	18.77	17.77	19.14	F=1.32	0.274
	SD	2.62	3.1	2.9		
Gender (% within group type)	**Female**	63.6	77.3	59.1	X^2=1.77	0.41
	Male	36.4	22.7	40.9		
ACE-III at baseline	**Mean**	95.45	94.82	94.5	F=0.52	0.596
	SD	2.56	2.81	3.94		

Key: MEST= Memory Specificity Training; ACE-III= Addenbrooke's Cognitive Examination-III

3.2.2.Materials:

Autobiographical memory specificity:

The standard Autobiographical Memory Task (AMT; Williams & Broadbent, 1986; Dalgleish et al., 2007) was administered using exactly the same procedure as that described in Chapter 2 as a measure of ability to recall specific autobiographical memories. A random sample of 90 memories from the AMT (30 from the MEST group, 30 from life review group and 30 from the control group) was rated by an independent rater who was blind to group type for the purpose of analysing inter-rater reliability of the outcome measure. Inter-rater reliability for specific vs general was good, K=0.82 with a percentage agreement of 92.2%.

Social problem-solving ability:

The Means End Problem-Solving Procedure (MEPS; Platt & Spivack, 1975) was administered in exactly the same way as that described in Chapter 2 (See Appendix 1). A random sample of 72 problem solutions (24 from the MEST group, 24 from life review and 24 from the controls) was rated by an independent rater who was blind to group type for the purpose of analysing inter-rater reliability. The intra-class correlation coefficient was .85 for number of relevant means, and .72 for effectiveness ratings.

Self-rated depression:

The depression subscale of the Hospital Anxiety & Depression Scale (HADS; Zigmond & Snaith, 1983) was used as described in Chapter 2.

Independence:

The instrumental & basic activities of daily living scales (IADL, ADL) (Lawton & Brody, 1969; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963) (IADL; 0-8 & ADL; 0-6) and the functional limitations profile (FLP; Pollard & Johnston, 2001) (0-1150) were used as in Chapter 2.

Executive function:

The Random Number Generation task (RNG; Towse & Neil, 1998) was used as a measure of executive function as described in Chapter 2.

All measures have previously been used with older adults. They were selected due to previous evidence of relationships with autobiographical memory, for their user acceptability, brevity and lack of need for complex equipment.

Feedback questionnaire:

Participants in the life review and MEST group were also given an optional feedback questionnaire at the end of the post-training session to complete if they wished to comment on their experience of the intervention. This was the same feedback questionnaire that was used in Chapter 2 (See Appendix 3). This contained seven open-ended questions such as *"Did you feel you benefitted in any way from taking part in the training program, and if so, how?"* and was completed and returned anonymously.

Interventions:

Memory Specificity Training (MEST; Raes et al., 2009):

The aim of the MEST intervention was to improve the specificity of older adults' retrieval of autobiographical memories by providing systematic practice in this task. Following Raes et al.'s (2009) method, the MEST program involved participants attending sessions in small groups of 4-6 participants. Following an introduction session, there were 1 hour weekly sessions, over 4 consecutive weeks. In each session participants were asked to recall memories of specific events in response to positive, negative and neutral cue words. Participants were instructed to try to recall

memories of events that lasted less than a day on one particular occasion. Participants were also given homework tasks to complete which provided a further 10 cue words each week so that participants could continue practicing retrieving memories. Included in the homework was also a 'specific memory of the day' task in which participants were required to write down a specific memory every evening from each day of the week in between the group sessions. The total number of specific memories participants had the opportunity to practice recalling was approximately 71, plus 8 extra cue words if time permitted during the group sessions (i.e. 2 potential extra memories per week).

Life review (Serrano et al., 2004):

Following Serrano et al.'s (2004) protocol, the life review intervention consisted of 1 hour weekly sessions, over 4 consecutive weeks. Following an introduction at the beginning of the first intervention session, participants were asked to practice retrieving specific autobiographical memories of events that lasted less than one day, on one particular occasion. Each session was conducted one-to-one with a researcher. The aim of the intervention was to improve autobiographical memory retrieval in older adults for specific life events, with a focus on positive memories, within a life review context. Participants were asked 14 questions in each session designed to prompt specific memories, e.g. "Can you tell me about something that your father/mother did one day when you were a child that brought you happiness?" (Serrano et al., 2004). The questions were related to a particular life period each week, i.e. childhood, adolescence, adulthood and finally a summary. In addition, participants were asked to complete a homework activity each week in which they were required to write down specific memories in response to similar written prompting questions. The total number of specific memories participants had the opportunity to practice recalling was approximately 77.

Control workbook:

The control group was asked to complete a workbook at home over the course of 4 consecutive weeks. They were also offered the opportunity to receive autobiographical memory training at the end of the study after they had completed the 3-month follow up (see Section 3.5). The control workbook consisted of cognitively stimulating activities that were not directly related to autobiographical memory (i.e. crossword and Sudoku puzzles). The purpose of this was to ensure that those in the control group were also

actively completing cognitively stimulating tasks, but without specifically influencing autobiographical memory retrieval.

3.2.3.Procedure:

Participants first completed pre-training assessments to provide baseline measures of cognitive function, autobiographical memory specificity, self-rated depression, social problem-solving ability and independence. Participants were then randomly allocated to either an intervention (MEST or life review) or control group using the same randomisation technique as that described in Chapter 2, Section 2,2,3). After an introduction to the assigned activity type, the interventions and control activity took place over the following 4 weeks. Participants completed a post-training assessment session in the 5th week, and finally a follow up 3 months after the post-training session.

3.3.Results

Baseline performance

There were no significant differences in baseline AMT scores, depression ratings, social problem-solving, or measures of independence (see Table 3.2), all tests p>.05. There was, however, a significant difference in baseline redundancy scores between groups; $F(2,63)$=3.47, p=.037. A t-test revealed that redundancy scores of the MEST group were significantly higher compared to the life review group, t(42)=-2.31, p=.026, indicating higher updating ability in the life review group (see Table 3.2 for means and S.Ds). The mean AMT score of the current sample (M=0.7, SD=0.19) is comparable to the mean AMT score of a previous study (M=0.69, SD=0.12) with healthy older adults, which found that older adults retrieved significantly fewer specific memories than younger adults (Holland et al, 2012). This suggests that the older adults in the current sample have age-related reduced autobiographical memory specificity as expected. The mean RNG index (M=0.27, SD=0.06) and redundancy (R) scores (M=1.56, SD=1.16) of the current sample are also comparable to the mean RNG index (M=0.19, SD=0.10) and R scores (M=2.78, SD=1.93) in Holland et al's (2012) sample.

Missing data:

One participant did not complete the FLP in the pre-training session, and one participant did not complete the ADL, IADL, or FLP at 3-month follow up due to running out of time during the follow up session as the participant had to leave. All other data

from these two participants was included because their data still enabled the key questions concerning specificity and mood to be addressed.

Adherence to intervention:

All participants in the life review group attended every intervention session. Three participants in the MEST group missed one of the group sessions due to illness. The proportion of intervention sessions attended by the MEST group was therefore: mean=0.97, SD=0.07.

Table 3.2. Means and standard deviations of all relevant variables at pre-training, post-training and 3-month follow-up.

Variable		Pre-training mean (SD)			Group difference at baseline		Post-training mean (SD)			2 (time) x 2 (group) interaction		3-month follow up mean (SD)			3 (time) x 3 (group) interaction	
		MEST (n=22)	Life review (n=22)	Control (n=22)	*F* value	*P* value	MEST (n=22)	Life review (n=21)	Control (n=22)	*F* value	*p* value	MEST (n=21)	Life review (n=22)	Control (n=19)	*F* value	*p* value
AMT-pS		0.71 (0.22)	0.71 (0.16)	0.69 (0.18)	0.09	0.918	0.85 (0.14)	0.85 (0.15)	0.71 (0.2)	3.3	0.043*	0.78 (0.18)	0.76 (0.25)	0.73 (0.2)	1.71	0.153
AMT Positive-pS		0.69 (0.28)	0.7 (0.18)	0.73 (0.27)	0.13	0.881	0.82 (0.2)	0.8 (0.25)	0.68 (0.25)	2.49	0.091	0.76 (0.27)	0.73 (0.27)	0.71 (0.23)	2.06	0.091
AMT Negative-pS		0.7 (0.25)	0.73 (0.24)	0.65 (0.21)	0.67	0.518	0.89 (0.15)	0.9 (0.14)	0.75 (0.24)	0.82	0.445	0.8 (0.19)	0.79 (0.27)	0.76 (0.25)	0.48	0.752
MEPS	**No. Relevant means**	3.58 (0.7)	3.95 (1.44)	3.23 (0.86)	2.6	0.083	3.63 (0.84)	4.05 (1.59)	3.01 (0.95)	1.22	0.302	3.58 (0.64)	3.83 (1.44)	2.89 (0.9)	0.77	0.547
	Effectiveness (0-7)	3.76 (1.02)	4.01 (1)	3.47 (1.12)	1.47	0.237	3.88 (0.94)	3.95 (1.1)	3.17 (1.11)	3.64	0.032*	3.84 (0.88)	4.08 (1.02)	3.36 (1.17)	1.76	0.142
HADS Depression (0-21)		3.18 (1.89)	2.86 (2.19)	2.64 (1.5)	0.47	0.629	3.5 (2.74)	2.86 (2.29)	3.23 (1.63)	0.61	0.548	3.14 (2.13)	2.55 (2.15)	2.68 (2.24)	0.25	0.909
ADL (0-6)		5.95 (0.21)	5.86 (0.35)	5.95 (0.21)	0.85	0.433	5.95 (0.21)	5.95 (0.22)	5.91 (0.29)	1.51	0.228	5.95 (0.22)	5.86 (0.36)	5.89 (0.32)	1.39	0.243
IADL (0-8)		7.95 (0.21)	7.95 (0.21)	7.95 (0.21)	0	1	7.95 (0.21)	8 (0)	7.95 (0.21)	1.05	0.356	7.95 (0.22)	8 (0)	8 (0)	0.79	0.534
FLP (0-1150)		294.5 (152.24)	209.41 (162.23)	312.05 (150.89)	2.72	0.074	301.55 (159.53)	182.1 (143.79)	326.23 (149.16)	0.54	0.586	323.48 (166.12)	244.38 (182.05)	323.84 (149.58)	0.5	0.734
RNG		0.27 (0.07)	0.25 (0.04)	0.28 (0.08)	1.72	0.187	0.27 (0.08)	0.24 (0.05)	0.26 (0.07)	0.45	0.643	0.25 (0.06)	0.27 (0.05)	0.29 (0.07)	1.48	0.212
R		2.02 (1.65)	1.14 (0.7)	1.52 (0.71)	3.47	0.037*	2.26 (1.58)	1.44 (0.81)	1.62 (1.3)	0.07	0.929	2.38 (1.84)	1.62 (1.01)	1.53 (1.15)	0.29	0.882

*Key: MEST= Memory Specificity Training; AMT-pS= Proportion of specific autobiographical memories recalled on the Autobiographical Memory Task; AMT Positive-pS= Proportion of specific memories recalled in response to positive cues; AMT Negative-pS= Proportion of specific memories recalled in response to negative cues; MEPS=Means End Problem-Solving Procedure; HADS=Hospital Anxiety and Depression Scale; ADL=Activities of Daily Living index of independence; IADL= Instrumental Activities of Daily Living scale; FLP= Functional Limitations Profile total score; RNG=Random Generation Number Index; R=Redundancy score. *Indicates p value significant to <.05.*

Effect of interventions at post-training on autobiographical memory specificity:

A 3 group (Life review, MEST, and Control) x 2 time (Pre and post-training) mixed factorial ANOVA was conducted with the proportion of specific memories on the AMT (AMT-pS) as the dependent variable. Statistics are displayed in Table 3.2. Results revealed a significant group x time interaction: $F(2,62)=3.3$, $p=.043$, partial eta squared (ηp^2)=0.096. A series of one-way ANOVA confirmed that although there was no significant difference between the groups at pre-training, $p>.1$, at post-training AMT-pS differed significantly between the groups, F(2,62)= 5.17, p=.008. Participants in the MEST and life review groups recalled a significantly greater proportion of specific memories than did the controls; t(42)=2.76, $p=.008$ and t(41)=2.51, $p=.016$ respectively. There was no difference between the MEST and life review groups at post-training, $p>.1$. Furthermore, planned pairwise comparisons showed that while AMT-pS did not differ across time in the control group ($p>.1$), there was a significant increase across time on AMT-pS in the MEST, t(21)= 3.27, $p=.004$ and life review groups, t(20)=4.36, $p<.001$ (see Figure 3.2).

Since depression has previously been related to autobiographical memory specificity, change in depression scores was also examined as a covariate to check whether a decrease in depression ratings accounted for the increase in autobiographical memory specificity. Change scores were calculated by taking the difference between scores at post-training and pre-training. The results remained significant, $p<.05$, thus, indicating that changes in autobiographical memory specificity could not be explained by changes in depression.

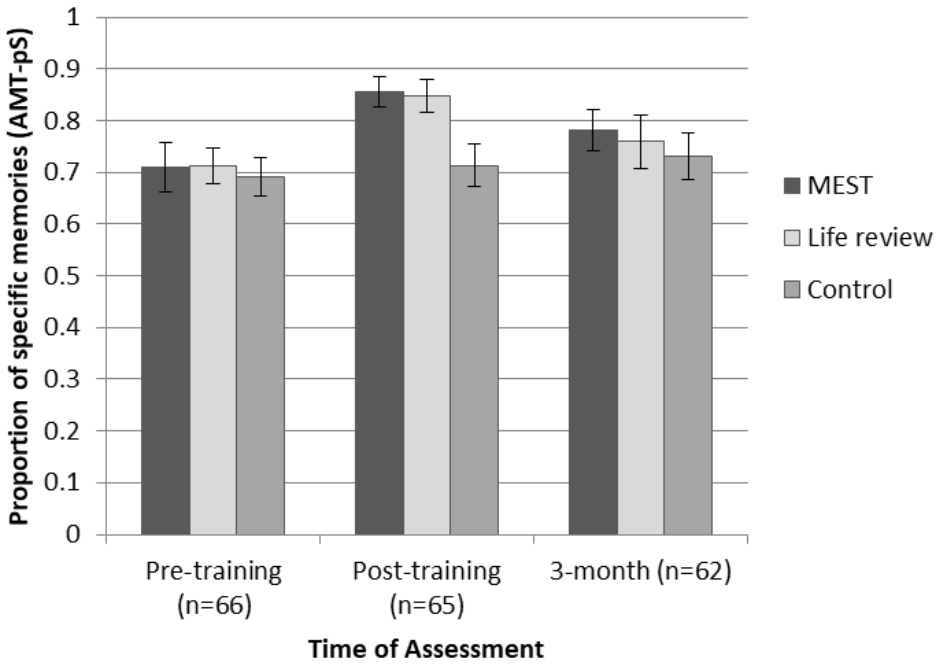


Figure 3.2. Proportion of specific memories recalled at each time point in each group. Error bars represent +/- 1 standard error of the mean.

Key: AMT-pS= Proportion of specific memories recalled on the AMT (0-1)

Long-term effects of interventions on autobiographical memory specificity:

In order to assess whether improvements in autobiographical memory specificity were maintained in the intervention groups relative to controls after a 3-month follow up period, a 3 group (Life review, MEST, and Control) x 3 time (Pre, post, 3-month) ANOVA was conducted with AMT-pS as the dependent variable. This revealed no significant interactions, indicating that autobiographical memory specificity did not remain significantly higher than controls in either of the intervention groups at 3-month follow up (see Figure 3.2), $p>.1$.

Analysis of secondary outcome measures:

In order to determine the effect of the interventions on the secondary measures of social problem-solving (MEPS), depression ratings (HADS), independence (ADL; IADL; FLP), and executive function (RNG index; Redundancy score) a series of 3 group (Life review, MEST, and Control) x 2 time (Pre and post-training) mixed factorial ANOVA were conducted with each secondary measure as the dependent variable (see Table 3.2 for statistics).

Social Problem-solving:

On the measure of MEPS effectiveness ratings, a significant group x time interaction was revealed: $F(2,62)=3.64$, $p=.032$, $\eta p^2=0.11$. One-way ANOVA confirmed that although there was no significant difference between the groups at pre-training, $p>.05$, at post-training there was a significant difference between groups, $F(2,62)=3.62$, $p=.033$. MEPS effectiveness was significantly higher in the MEST, $t(42)=2.29$, $p=.027$ and life review groups $t(41)=2.29$, $p=.027$) compared to controls at post-training. However, pairwise comparisons showed that there were no significant effects of time on MEPS effectiveness in either the life review or MEST groups, $p>.1$, whilst it did significantly decrease from pre-training to post-training in the control group, $t(21)= 2.37$, $p=.028$). There were no group type x time interactions on the number of means generated on the MEPS task, $p>.1$.

In order to assess whether differences between groups were maintained after a 3-month follow up period, 3 (Life review, MEST, and Control) x 3 (Pre, post, 3-month) ANOVAs were conducted. There were no significant interactions on either the MEPS number of means or MEPS effectiveness, indicating that none of the above effects on social problem-solving ability at post-training were maintained after a 3-month follow up period, $p>.1$.

Depression:

There were no significant group x time interaction effects on HADS depression ratings, either at post training or 3-month follow up, $p> =.1$. However, a floor effect was observed with 51.51% of the sample scoring below 2 out of 21 on the HADS depression rating scale at pre-training. None of the participants scored above the recommended cut-off for mild depression (8 out of 21; Zigmond & Snaith, 1983) at baseline.

Independence:

There was a significant main effect of time on total FLP scores, $F(2,114)=3.78$, $p=.026$, $\eta p^2=.062$. A significant linear contrast was observed, $F(1,57)=4.16$, $p=.046$, $\eta p2=0.07$ indicating that FLP increased linearly (more limitations) across the three time points. There was no significant interaction between time and group type, p>.1.There were no group x time interactions on any of the subscales of the FLP, or on the ADL or IADL, $p>.05$.

There was a ceiling effect on the ADL and IADL measures, with 92.42% scoring > 5 out of 6 on the ADL measure, and 95.45% scoring > 7 out of 8 on the IADL measure at pre-training.

Executive function:

There were no significant interaction effects on the RNG index or Redundancy scores, either at post training or 3-month follow up $p>.1$.

Cue valence:

The effect of cue valence was examined using a 2 (positive and negative) x 2 (pre and post) x 3 (life review, MEST and control) ANOVA. However, there were no interactions with cue valence, $p>.05$.

Relationship between initial executive function and change in AMT:

In order to test the hypothesis that both methods would be particularly helpful for people with lower executive function, the relationships between baseline executive function and change in AMS-pS (calculated by taking the difference between pre-training to post-training) were examined. Correlations between pre-training RNG index, pre-training R scores and change in AMT-pS were explored for each group separately. Change scores were also calculated separately for proportion of specific memories recalled in response to positive cues (AMT Positive-pS), and to negative cues (AMT Negative-pS). All variables reported were normally distributed as assessed by Shapiro-Wilk's test, $p > .05$, except for Redundancy (R) and change in AMT Negative-pS in the MEST group, and R in the life review group, therefore, Spearman's rho correlation coefficients were examined for these variables.

There were no correlations between pre-training RNG, R and change in AMT-pS scores, in the MEST or control groups, $p>.1$. There was a significant positive correlation between pre-training RNG index in the life review group and change in AMT Positive-pS, $r=0.5$, $p=.02$. This suggests that in the life review group, lower executive function at baseline (i.e. higher RNG index) was related to greater change in recall of specific positive events. Further correlations were performed in order to check whether this finding could be explained by people with higher executive function being more likely to have higher memory specificity at baseline, and therefore, have less room for change/improvement. There were no significant correlations between pre-training RNG index and pre-training AMT-Positive-pS, $p>.1$, suggesting this was not the case. Percentage change scores (as opposed to absolute change above) for AMT Positive-pS were also calculated to examine change whilst taking into account baseline scores, and the correlation remained significant, $r_s=0.44$, $p=.05$.

Relationships between changes in variables:

Change scores were calculated for each measure by taking the difference between scores at 3-month follow up and pre-training. Correlations between change in AMT-pS and change in the following: MEPS (number of means and effectiveness rating); HADS depression ratings; and FLP total scores, were first analysed in the whole sample (*N*=66). All pairs of variables reported here were normally distributed, as assessed by Shapiro-Wilk's test, $p > .05$. Results revealed significant positive correlations between change in AMT-pS and change in MEPS number of means r=0.38, p=.003, and between change in AMT-pS and change in MEPS effectiveness ratings, r=.25, p=.046. A significant negative correlation was also observed between change in AMT-pS and change in FLP total score, r=-.27, p=.035. Therefore, improvement in recall of specific autobiographical memories overall was positively related to improvement in social problem-solving ability, and negatively to functional limitations profile score (i.e. reduction of functional limitations). There were no other significant correlations between change in AMT-pS and any of the other variables.

The above analysis was also conducted with each group separately (MEST, n=21; Life review, n=22; control, n=19). All pairs of variables reported were normally distributed as assessed by Shapiro-Wilk's test, $p > .05$, except for the 'Change in MEPS no. means' variable in the life review group which violated the assumption of normality (p>.05). Therefore, Spearman's rho correlation coefficient is reported for the relationship between change in AMT-pS and change in MEPS number of means in the life review group only. The results revealed that change in AMT-pS was positively correlated with change in MEPS number of means in the MEST group, r=0.53, p=.014, and the life review group, r_s=0.5, p=.018, but not in the control group (p>.1). Therefore, improvement in recall of specific autobiographical memories overall was positively related to improvement in social problem-solving ability in both of the intervention groups separately. Correlations between change in AMT-pS and FLP total scores were not significant for any of the groups individually, p>.1. There were no other significant correlations between change in AMT-pS and any of the other variables in each group, p>.05.

3.3.1.Qualitative analysis of feedback questionnaires:

Thematic analysis (Braun & Clarke, 2006) was conducted on the responses participants gave on the feedback questionnaires that were returned in order to analyse and interpret the participants' experiences of the intervention.

MEST:

Feedback forms were returned anonymously by 17 participants out of the 22 participants who took part in the MEST intervention. Analysis resulted in 3 key themes:

1) "Acceptability" (with 3 sub-themes):

a. Onerous, but acceptable: Participants reported that activities were onerous at times, but they also felt this was justified as they recognised that any training intervention needs to be challenging in order to be effective.

b. Relevance to everyday use of memory: Three participants did not feel this type of memory intervention was relevant or helpful to their experiences of everyday memory lapses. The focus on autobiographical memory lacked importance to them, and there was instead the suggestion that tips or strategies for dealing with perceived everyday difficulties, for example, maintaining or improving working memory, may have been more useful.

c. Side effect of unpleasant memories: The inclusion of negative cue words led to participants retrieving unpleasant memories. Sometimes they did not feel comfortable sharing these memories within a group. In some cases this led participants to question the reasoning behind the activities in which they were given negative cue words. For example:

> "It was just an opportunity to reminisce and not always pleasant memories. I personally do not like to dwell on the past."

> "I try not to dwell on past negative experiences."

2) "Feasibility":

The task of recalling a specific memory in response to a cue word was considered by participants to be very difficult. The difficulty seemed to lie not just in moving past general memories in order to retrieve a particular event, but also in terms of associating memories to the cue words, which were often perceived to be abstract. This also links to the sub-theme 1b."Relevance to everyday memory" as the recall tasks seemed repetitive and lacked relevance to participants because the cue words did not always have personal meaning to individuals. For example:

> "..finding events to some words which were vague, e.g. 'content', 'disappoint'. I felt that a less abstract word might have helped me to remember a significant event."

3) "Outcome assessment" (with 2 sub-themes):

a. Social benefit: A number of participants enjoyed the social aspect of the MEST training in particular. They commented on the benefit of having the opportunity to meet new people, and enjoyed the interaction element of the program. They also found it interesting to hear other people's responses to the cue words and to share similar experiences.

b. Mental stimulation: One of the main positive outcomes of the program seemed to be that participants found it an interesting experience and that the challenging nature of the activities provided general mental stimulation, even if there were no specific improvements in memory.

Life Review:

Feedback forms were returned anonymously by 14 participants out of the 22 participants who took part in the life review intervention. Analysis resulted in 3 key themes;

"Acceptability":

The majority of participants found the activities to be a reasonable amount, with one even saying they didn't feel it was enough and they would have liked to receive more homework.

"Feasibility":

A number of participants found it difficult to retrieve a memory of one particular event, rather than general memories. Although this was challenging, the main difficulty was then in recalling the details attached to that event, such as how they felt at the time. For example:

> "Pin pointing to specific events of less than one day in one's past is remarkably difficult."

> "…remembering how one felt at the time and what other sensations one had is much more difficult"

"Outcome assessment" (with two sub-themes):

a) Life satisfaction: The majority of participants found that recalling memories of positive events from their past was an enjoyable experience. The activities gave participants the opportunity to reminisce, bringing back happy memories that they hadn't thought about

for a long time. In many cases, this led to an overall feeling of gratefulness and satisfaction. For example:

> "I feel that focusing on so many memories which have been temporarily forgotten has helped me to appreciate that my life has been filled with happy experiences. Looking back has made me feel amazingly lucky and grateful for all the positive influences in my life. This gives me a feeling of peace and satisfaction."

In one case, even though unpleasant memories were also triggered during the program, they felt they could look back on these from a positive perspective:

> "It has helped me to bring many happy memories to the forefront. Any unhappy memories I was able to cope with and realise how lucky I was to be able to overcome them and how much stronger it has made me. I hope it will help me and others for the future."

b) Effect on recall style/perspective: Similarly to those in the MEST group, participants commented on the beneficial mental stimulation the activities gave them. Further to this, they commented on how the activities had altered their perspective on memory, viewing memories in a different light and focusing more on positivity whilst looking back. For example:

> "I recalled incidents that at the time I didn't think (of) as happy, but now, many years later, I have realised they were."

Summary of qualitative feedback:

Overall there were some subtle differences between the experiences of the two groups. The main benefit of MEST seemed to be the social aspect of being part of a group, whereas the main benefit of life review was the focus on happy memories that were personally meaningful and uplifting. The extent of homework activities in the MEST group were perceived as onerous, but still acceptable and provided beneficial mental stimulation. The life review method had a greater perceived positive effect on mood, but may be improved by including more homework activities to make it more challenging.

3.4.Discussion

The aims of the current chapter were firstly to examine whether two AM training methods can effectively improve AMS and secondary measures related to wellbeing in healthy older

adults. A secondary aim was to tease apart the features of the training methods that account for their effectiveness, focusing on the two main mechanisms of executive function and positive appraisal. The first hypothesis that those receiving an intervention would exhibit improvements in autobiographical memory specificity relative to controls immediately following training was supported. This extends previous findings supporting the effectiveness of the MEST and life review programs in various populations (Raes et al., 2009; Neshat-Doost et al., 2013; Moradi et al., 2014; Serrano et al., 2004; Latorre et al., 2015) to a healthy, independently living older adult population. Moreover, this improvement was not accounted for by change in depression.

The second hypothesis that improvement in autobiographical memory specificity would be maintained after 3 months was unsupported. Participants were not asked to continue practicing the activities after the intervention period, meaning they may not have integrated specific memory recall into their everyday lives, resulting in a shift back towards over-general memory. This is in line with findings from the qualitative analysis of the MEST training as participants felt recalling past memories was not relevant or helpful in their everyday lives, possibly affecting their motivation to continue the practice. Future studies may consider booster sessions or re-designing the MEST activities in a real-life context. For example, asking participants to recall a specific memory in response to a hypothetical situation, such as 'One morning you are feeling down and your self-esteem is low after you received a negative comment from a colleague at work. Recall a specific memory when you felt confident about something', as opposed to asking participants to recall a specific memory in response to a simple cue word such as "confident". It has been evidenced that the type of task instruction used can influence the over-generality effect in older adults. For example, Ford, Rubin and Giovanello (2014) suggest that the verbal word cue tasks commonly used in autobiographical memory research magnify over-general memory in older adults because they involve reliance on executive function to maintain task instructions. When musical cues were used as a more emotional cue, executive function was not related to autobiographical memory specificity (Ford et al., 2014) which contrasts with findings of previous studies that used verbal cues (Addis, Wong, & Schacter, 2008; Ros et al., 2010; Piolino et al., 2010). Musical cues may also facilitate autobiographical retrieval by increasing arousal or reducing anxiety (Foster & Valentine, 2001). Furthermore, musical cues aid retrieval more so in older adults than in younger adults (Schulkind & Woldorf, 2005). This may be because older adults can relate memories to emotional cues. In support of this, the over-generality effect in older adults is reduced in response to emotional cues compared to neutral cues (Holland et al., 2012). Therefore, using cues that older adults can relate to emotionally may enhance long-

term performance by reducing executive control demands and capitalizing on the emotional focus in later life.

The third hypothesis that intervention groups would exhibit improvements on secondary measures relative to controls was unsupported since no quantitative effects on depression or independence were observed. The floor effects in the measures of depression and ceiling effects in activities of daily living could account for this as there was little potential for improvement. Therefore, the hypothesis that there would be more improvement in mood in the life review group than in MEST was also unsupported. However, qualitative analysis indicated that life review had a beneficial impact on mood as participants reported a positive experience and feeling of life satisfaction, although this was not detected in the quantitative measures (i.e. HADS score). It is unlikely that this was due to demand characteristics since these benefits were only reported by participants in the life review group, and not by participants in the MEST group. In Chapter 4 a measure of life satisfaction will be included to assess whether there is a significant quantitative effect to support the reported qualitative effect.

The hypotheses that change in mood would be related to increase in specific recall of positive events was unsupported as there was no change in mood and no effect of cue valence in the current study. The lack of effect of cue valence in the current study may be explained by the generally high executive function of the current sample since people with memory problems were screened out, potentially masking any effect.

The current findings revealed that, in the life review group only, people with lower baseline executive function (i.e. higher RNG index indicating lower inhibition) also had higher change scores in recalling specific positive memories. Similarly, the findings reported in Chapter 2 indicated that participants (in the whole sample) with the lowest inhibition ability at baseline (according to the measure of adjacency on the RNG task) had the biggest improvements in specific recall, however, in Chapter 2 this was particularly in relation to negative memories. Together these findings support the hypothesis that specificity training may be particularly helpful for people with lower executive function. In Chapter 4 the effect of life review on AMS and the secondary measures will be examined in a sample of older adults with mild cognitive impairment, a group who are likely to have lower executive functioning and lower memory specificity.

It is noteworthy that in Chapter 2, people with the lowest inhibition ability exhibited the largest change in AMS, but only for negative memories, whereas in the life review group in the current study it was largest for positive memories. One of the conclusions from Chapter 2

was that older adults may be protected from a detrimental impact of reduced executive function on retrieving memories of a positive valence, suggesting that specific positive recall is less influenced by reduced executive control in older adults. It was proposed that focusing on executive processes may be helpful for improving access to specific negative memories, but not positive memories. However, the current finding that inhibition is linked to change in positive, rather than negative recall during life review contradicts this view. However, this is not surprising given that life review focused on positive memories only. As outlined in the introduction of this chapter, Ros et al (2017) proposed that older adults use cognitive avoidance strategies to control negative affect more efficiently. Previous research has found that older adults do use cognitive control processes to enhance positive memories and diminish negative memories (Mather & Knight, 2005). The findings of the current study suggest those with lower inhibition, and thus, less ability to regulate emotional material, may well benefit from focusing on enhancing or preserving recall of positive events during life review. This is in line with previous research that has suggested focusing on positive recall as a strategy may act as a buffer against OGM recall in older adults (Holland et al, 2012). Improving specific negative recall may not be necessary in older adults as, in contrast to younger depressed adults who have maladaptive avoidance strategies, older adults already deal with negative affect adaptively.

The hypothesis that executive function would improve in the MEST group and would be related to increase in autobiographical memory specificity was also unsupported since there was no change in executive function in any of the groups. Together with the lack of relationship between baseline executive function and change in AMT scores in the MEST group, a potential explanation for this is that the effect of MEST on autobiographical memory specificity is explained by simple practice effects, rather than by any impact on the executive processes involved in AM retrieval. The activities in the MEST training are very similar to the test used to measure autobiographical memory specificity (the AMT) in that it involved multiple cue word tasks. Thus, it is reasonable to conclude the improvement observed was due to practice effects. It would be useful to include a parallel measure, such as the Sentence Completion for Events from the Past Tense (SCEPT; Raes, Hermans, Williams & Eelen, 2007), to examine this further. The SCEPT comprises of sentence stems which probe for past experiences without explicitly asking participants to recall specific memories as the task is not presented as a memory “test”. For example, participants are asked to complete a sentence such as ‘‘When I think back to/of...’’ and responses are scored for specificity using the same codes used in the AMT.

In support of the hypothesis that changes in variables would be related, overall change in autobiographical memory specificity was significantly related to overall change in social problem-solving in the intervention groups. Thus, those who improved the most in recalling specific autobiographical memory recall also improved the most in social problem-solving. This corresponds with the constructive episodic simulation hypothesis which states that similar episodic processes underlie both retrieving AMs and generating solutions to social problems (Schacter & Addis, 2007; 2009). This provides further support for the implication that improving autobiographical memory retrieval may also have beneficial effects on generating solutions to social problems is important in this age group.

Functional limitations increased from pre-training to 3-month follow up in the total sample, indicating increased functional impairment over time. However, there was a significant negative relationship between overall change in autobiographical memory specificity and overall change in functional limitations in the whole group, showing that people who improved the least in autobiographical memory specificity (or did not improve or got worse) also had bigger increases in functional limitations, i.e. became more functionally impaired. Thus, those who improved the most in their autobiographical specificity showed more reduction in limitations (improvement in function). This supports the previously suggested role of ability to recall specific autobiographical memories in maintenance of independence in older adults (Holland et al, 2012). The implication of this is that improving AMS may be useful for reducing functional limitations in older adults, although this should be taken with caution as there were no significant improvements (i.e. reductions) in functional limitations in the interventions groups who did improve their AMS. The lack of a relationship between these variables in the separate groups when examined individually may be due to the smaller sample sizes.

The finding that there was little quantitative difference in effectiveness between the two intervention groups indicates that autobiographical retrieval practice, which was the main component of both programs, accounted for the improvement in autobiographical memory. This is one of the first studies to examine MEST training with older adults, and whilst it had similar quantitative effects to life review, it emerged from the qualitative feedback that MEST did not have a perceived effect on mood from the participants' point of view, whilst participants who did life review reported increased life satisfaction. There are some theoretical differences in design between MEST and life review that may account for this.

First, participants found it difficult to relate personal events to cue words that did not have any personal meaning to them, that is, the difficulty was not just in reaching a specific

memory, but in relating memories to single words which were perceived as abstract or open to interpretation. Although participants in the life review group reported difficulty pinpointing specific events, they received a benefit from recalling meaningful, personal events from their life that had value to them. Thus, life review acknowledged the unique experiences of the individual, emphasising the overall value of their life, whilst the recall tasks in the MEST training may have prompted random, less meaningful memories of isolated events, seeming to lack importance to participants. Interventions which frame autobiographical memory specificity practice in the context of a therapeutic program such as life review may be more suitable for older adults because it is in line with the natural life review process proposed by Butler (1963). In light of this, although over-general memory in older adults represents vulnerability to depression, perhaps this is not for the same reasons that it does in younger adults. In younger adults it has been suggested that over-general memory mediates depression through increased rumination and experiential avoidance (Raes et al., 2006; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), and programs such as MEST are based on this theory. However, in older adults, over-general memory may mediate depression by impairing the natural reminiscence process, preventing integration of past specific memories into a positive narrative. Older adults tend to recall self-defining memories that have more integrative meaning than younger adults (Singer, Rexhaj, & Baddeley, 2007). "Meaning-making" and integrative reminiscences are important therapeutic tools for psychological well-being alongside specificity, rather than the simple recall and retelling of memories (Singer, Blagov, Berry, & Oost, 2013; Blagov & Singer, 2004; Thorne, McLean, & Lawrence, 2004; Afonso, Bueno, Loureiro, & Pereira, 2011; Wong & Watt, 1991). If impairment of integration due to reduced autobiographical memory specificity is the mechanism that accounts for the relationship between lower autobiographical memory specificity and reduced emotional health in older adults, this would help explain the different outcomes of the two interventions in this age group since life review included this element of integration. Future work may examine this by analysing the integrative content of the memories retrieved during the life review sessions and by including a measure of life satisfaction, and by including a measure of rumination to confirm this hypothesised difference to younger adults.

Memory-based interventions for older adults such as traditional life review and reminiscence have previously been suggested to be enjoyable (Merriam, 1993) but lack empirical evidence as standard, structured interventions (Bluck & Levine, 1998). Findings from the current study suggest that a focus on the cognitive trait of autobiographical specificity incorporated into a traditional life review context offers a structured intervention that offers both a quantitative effect on autobiographical memory, and is acceptable and engaging to participants.

Another key difference is that life review focused exclusively on positive memories, whilst the MEST program also incorporated negative memories. Qualitative analysis in the current study suggested the MEST group found the negative recall to be an unpleasant experience and did not understand the purpose of it. It can be argued that the purpose of MEST to reduce a bias towards negative memories and prevent them becoming over-generalised in depressed populations is less comprehensible in a population of non-depressed older adults since they claimed not to dwell on negative experiences beforehand. Furthermore, when negative memories were spontaneously retrieved, participants in the life review group could cope with them or even view them from a positive perspective as they were within the context of one's whole life. This is in line with the suggestion that older adults may be more able to reflect positively and find greater meaning in their self-defining memories, providing opportunities for lesson-learning (Singer et al., 2007). This supports the suggestion that age may have an interactive effect so that the helpfulness of recalling specific negative memories depends on the age group, i.e. it may be helpful in younger adults but not in older adults. Therefore, life review appears to be more suitable for this population, although MEST could also be modified to focus on positive memories that are life relevant.

Lastly, the format of the two interventions was different: MEST was group-based whilst life review was delivered one-to-one. Feedback from the MEST group referred to a social benefit. It has been suggested that the process of sharing autobiographical memories with others may be important to their functional use (Alea & Bluck, 2003). MEST gave the additional benefit of sharing memories with others from the same generation, rather than just with the researcher as they did in life review. This may have helped prompt era specific memories, such as those related to historical periods, e.g. World War II. In support of this, individuals tend to collaborate and co-construct memories with others (Gould & Dixon, 1993; Edwards & Middleton, 1986), and similarity in speaker-listener characteristics are suggested to support the memory sharing process (Alea & Bluck, 2003). However, some participants in the MEST group reported that they did not feel comfortable sharing some particularly personal memories within a group setting, whereas in life review participants may have been more open to disclosing personal memories with the researcher in a more private setting.

Strengths and limitations:

Although our sample size was modest, it was larger than other studies which have found large effects on autobiographical memory specificity (Heeren et al., 2009; Neshat Doost et al., 2013; Raes et al., 2009). Another limitation is that the different formats for the interventions and control group, i.e. group vs one-to-one vs workbook, introduce a potential

confound as the level of contact with researchers and other participants was varied and the control group had the least contact. However, in the current study the control group was actively completing a cognitively stimulating task whilst previous MEST studies have used no additional contact controls (Moradi et al., 2014; Neshat-Doost et al., 2013). Future studies may address this issue further by including a better matched control group who receive the same level of contact as the intervention group. Furthermore, Lamers et al (2015) found that life review in a self-help format had similar effects in reducing depression as in a group format (Korte, Bohlmeijer, Cappeliez, Smit, & Westerhof, 2012), implying the benefits of life review are not just due to face-to-face contact with the researcher. The social interaction provided by group sessions has been found to have health-related benefits (Gleibs, Haslam, Haslam, & Jones, 2011). A second smaller study to address the potential confound of group benefits was conducted (see Section 3.5) to examine the effectiveness of the MEST training in the form of a workbook, instead of in a group setting. This allowed us to explore the extent to which the benefits of MEST are simply due to being part of a group, or due to practicing the recall activities themselves.

Finally, the procedure for assigning participants to conditions may not be truly random since the life review intervention was started later. Participants were also allocated at a ratio of 2:1 nearer the end of the study. However, participants were unaware of this and there is no reason to suspect that participants who were recruited later in the process were any different than those recruited earlier. Furthermore, there were no differences between groups in terms of demographics, primary or secondary measures (with the exception of redundancy) at baseline. The higher redundancy score in the MEST group compared to life review at baseline (indicating lower updating ability) is unlikely to have resulted from the randomisation procedure and did not affect any of the results since there were no significant effects relating to this measure.

Conclusions

In summary, the findings suggest that both MEST and life review programs have potential as methods of autobiographical memory specificity training in older adults, however, the lack of longer term effects suggest adaptations may be beneficial. The finding of an association between autobiographical memory specificity and both social problem-solving and functional limitations also has implications for older adults' wellbeing since these factors are both critical to healthy ageing. In terms of the underlying mechanisms of these methods, there were no direct effects on executive function, although those (in the life review group) with lowest inhibition ability at baseline showed greatest improvement in AMS, but only for

positive recall. The qualitative feedback further suggested life review may be a more acceptable method in this population due to a focus on more positive, meaningful specific recall. Overall, a focus on maintaining specific memories of a positive valence in training methods may be more useful than focusing on executive function in this population since older adults already compensate and adapt to deficits in executive function via enhanced emotional strategies. The current chapter has highlighted that life review may be more appropriate for improving AMS in healthy older adults. The next chapter will explore how useful life review is at improving AMS as a preventive strategy in a sample who are at increased risk of cognitive and wellbeing decline i.e. older adults with aMCI.

3.5. Study 2: Investigation of potential confound of a group format

Aims:

An uncontrolled trial examining the effect of MEST in the form of a workbook was conducted as a pilot study. The aim of this was to investigate whether the benefit of AM interventions such as MEST can be attributed to the social interaction provided by group sessions, as opposed to the training itself.

Method:

Participants:

Twenty participants (14 female, 6 male) aged 70-86 years (mean=76.89 years, SD=5.08) took part. Eight of these participants were recruited from the control group of the main study once they completed the 3-month follow up of the main study. The remaining twelve participants were recruited via the community through the same methods used for the main study (see Section 3.2.1: 'participants').

Materials and procedures:

For the eight participants who were originally part of the control group of the main study, their 3-month follow up AMT scores were used as a baseline. For the remaining twelve, a baseline AMT test was administered in the initial meeting with them. All participants scored above the recommended cut-off of 88 (Hsieh, Schubert, Hoon, Mioshi, & Hodges, 2013) on the ACE-III (Noone, 2015). The procedure for the AMT was exactly the same as that described in the 'materials' Section (3.2.2) of the main study.

Following completion of baseline measures, participants were given an introductory session

to the MEST workbook which they completed at home over the course of four weeks. In the week following completion of the workbook, participants completed post-intervention AMT assessments.

Results and discussion:

The mean AMT scores were as follows: Baseline mean=0.75, SD= 0.16; Post-intervention mean=0.82, SD=0.15. A paired samples t-test revealed that the proportion of specific memories recalled on the AMT did not significantly change from baseline to post-intervention, $t(19)=1.68$, $p=0.109$. This indicates that the MEST workbook did not have a significant effect on autobiographical memory specificity, suggesting that the improvement in AMS in the MEST group of the main study may be largely accounted for by the effect of social interaction. This implies that social interaction during the memory sharing process appears to be a key factor in determining the success of AM interventions.

Cohen's d effect sizes for paired samples t-tests were calculated for the current sample who completed MEST in a workbook format (d=0.38), and for the sample from Chapter 3 who completed MEST in a group format (d=0.7). The finding that the effect size is larger for the group who completed MEST in a group format supports that the social interaction element accounted for some, but not all, of the effect on AMS. The difference between effect sizes is 0.32, suggesting that the social interaction element of the group accounts for this discrepancy in effect sizes, but there is still an effect size of 0.38 that is attributed to the MEST activities alone, in isolation from the group benefit.

Chapter 4: Life review to improve autobiographical memory in amnestic Mild Cognitive Impairment (aMCI)

4.1.Introduction:

So far in this thesis only interventions with healthy older adults have been examined. The life review intervention was found to be the most suitable due to both its quantitative effects and the positive qualitative feedback it received. In order to develop this method as a preventive strategy, it is important to examine how useful it is for those at high risk of further cognitive and wellbeing decline. Therefore, an aim of the current chapter was to examine the effectiveness of the life review intervention in a sample of older adults with Mild Cognitive Impairment (MCI). MCI is characterised by deficits in cognitive ability that are more than expected for a person's age, in the absence of dementia. Although independence and basic activities of daily living are relatively preserved, there is a negative impact on individuals' wellbeing and diminished quality of life in MCI patients (Barrios et al, 2013). It is considered to be a transient phase which may represent those at high risk of progression to dementia, with 15–41% of MCI cases per year going on to develop Alzheimer's Disease (AD) or other dementias (for review see Apostolo et al, 2016). However, there are also promising findings of a reversal from this phase, with 44% of MCI patients returning to a non-MCI diagnosis a year later (Apostolo et al, 2016). This suggests that MCI represents a group whereby early interventions could provide support to prevent further decline in wellbeing.

Numerous studies have explored the variable types of memory deficits experienced in normal ageing ranging through to severe dementia in attempts to enhance our understanding of the changes that take place throughout the progression of the disease. Specific autobiographical memories (AMs) are impaired early in the process of AD, even whilst there are only subtle differences to normal ageing on other cognitive measures (Donix et al, 2010). It has been suggested that AM performance may be a more ecologically sensitive measure of decline than other laboratory based memory tests, such as verbal memory tests, as it involves more complex, emotional processing of memories related to the self (Berna, Schonknecht, Seidl, Toro, & Schroder, 2012). The rich contextual information

obtained from specific AM recall, which is degraded in AD, has importance to many processes of everyday life that contribute to preservation of wellbeing, for example, it has functions under three main categories: self, social, and directing the future (Bluck, 2003). Furthermore, Herzog, Kramer, Wilson, & Lindenberger (2009) highlight the need for cognitive ageing research to address the way in which changes to underlying cognition affect actual functioning in everyday life (see Section 1.4 in Chapter 1).

In previous chapters, the integral role of autobiographical memory to everyday social functioning, independence, and mental wellbeing has been emphasised, and the age-related decline in autobiographical memory specificity (AMS) in healthy older adults has been discussed. This deterioration is magnified in the amnestic subtype of MCI in which there is a particular impairment to memory, i.e. aMCI (Murphy, Troyer, Levine, & Moscovitch, 2008), and is further impaired in early dementia (Donix et al, 2010). For example, aMCI patients show higher AM performance compared to AD patients, but they have a deficit in this ability when compared to healthy older adults (Murphy et al, 2008). It is suggested that this difficulty could be due to reduced executive control, and executive functions are commonly found to be impaired in the earliest stages of AD (Greene, Hodges, & Baddeley, 1995). Patients with aMCI represent an intermediate stage in the deterioration of AM between normal ageing and development of AD (Donix et al, 2010). This subtype of MCI has been shown to have almost double the risk of conversion to dementia with respect to the other subtypes (Ravaglia et al., 2006). The current focus for research exploring prevention of dementia are interventions that promote social, mental, and physical activities aimed at increasing cognitive reserve (Mangialasche, Kivipelto, Solomon, & Fratiglioni, 2012). AMS is linked to the first two of these targets. Higher AMS is associated with better social functioning (Beaman et al., 2007), which can enable people to engage in intellectually demanding activities, e.g. attending group workshops and adult learning classes. It is thus proposed that whilst AM is still relatively preserved it is a potential target for preventive interventions in aMCI patients.

Social functioning

Autobiographical memory (AM) has been associated with some of the psycho-social risk factors for the development of MCI. Firstly, social participation is identified as an important protective factor (Apostolo et al, 2016). For example, having a large social network can reduce the manifestation of cognitive impairment, despite the presence of AD pathology (Bennett et al., 2006). As discussed in previous chapters, there is a clear link between AMS and social problem-solving and sharing AMs is considered to have three main social

functions: to develop and maintain intimacy, to elicit and provide empathy, and to teach or inform others (Alea and Bluck, 2003). It has also been suggested that reduced AM specificity in MCI and early AD may contribute to reduced social functioning in these groups, such as problems with social interaction-related daily routines (Reisberg, 2001; Reisberg et al, 2007). Maintaining valuable interpersonal relationships through social problem-solving is therefore pertinent in MCI patients. This link between AMS and social functioning in MCI may be explained by shared episodic processes thought to underlie both recalling details from the past and simulating future scenarios (Sheldon et al, 2015), such as social problems. Furthermore, these episodic processes are related to the medial temporal lobe in the brain, which is an area particularly affected by aMCI (Masdeu, Zubieta, & Arbizu, 2005). These problem-solving processes also have implications for other types of ill-defined problems such as financial management or medical decision making (Sheldon et al, 2015), which may help maintain independence in individuals living with aMCI. Finally, deficits in AM may contribute to carer burden by affecting ability to use AMs to fulfil the social functions of intimacy and empathy (Kumfor et al, 2016). Family members of MCI patients are also vulnerable to depression and lower life satisfaction (Ryan et al., 2012; Seeher, Low, Reppermund, & Brodaty, 2012). Thus, psycho-social interventions to support these important relationships with others that additionally contribute to the MCI patients' personhood and social identity are important.

Depression

Moreover, in addition to the benefits of social networks on cognition, having supportive social relationships helps people to deal with stress and maintain their mental wellbeing. Preserving mental wellbeing is important since depression is increasingly considered to be a risk factor for MCI and Dementia (Apostolo et al., 2016; Chung et al, 2015). Depression impacts the quality of life of people with MCI, with around 20% of people with MCI experiencing depressive symptoms (Lyketsos et al, 2002). Mental wellbeing is particularly affected in the early stages of dementia as self- awareness of one's difficulties and increasing reliance on others leads to grief and loss of self-esteem (Solomon, 1982; Bahro, Silber, & Sunderland, 1995). Early intervention to help improve mental wellbeing is therefore vital. One of the key targets for interventions in depressed populations is over-generalisation of AM (Raes et al, 2009). It is proposed that this target is even more important in aMCI since AMS is already deteriorated in this group. Furthermore, medial temporal lobe processes are affected by dementia pathology which hinder imagination of future events and may lead to hopelessness (Williams et al, 1996). This is proposed as a mechanism of the relation between OGM and development of depression. Together, this evidence suggests that

people with aMCI may be more at risk of depression, which possibly interacts with the risk of dementia, although the causal nature of these relationships remains unknown. It is proposed that since AM performance has implications for the preservation of mental health and social functioning, it is a vital target for preventive interventions for aMCI.

Sense of self

In the context of dementia research, there has been a drive to recognise personhood and esteemed sense of self (which is one of the functions of AM) as important concerns for dementia patients, perhaps particularly in the early stages whilst self-awareness remains preserved (Steeman, 2007; Caddell & Clare, 2013; Clare et al, 2011; Fazio & Mitchell, 2009). This drive prompted the development of a new model of dementia that promotes person centred care and recognises the personhood of the individual and how it affects quality of life in the context of cognitive decline (Kitwood & Bredin, 1992; Nolan et al, 2002; Keating & Gaudet, 2012; Murray & Boyd, 2012; Lawrence, Samsi, Banerjee, Morgan, & Murray, 2010; Millet, 2011; O'Connor et al, 2007). Researchers have since advocated interventions that recognise the relevance of the self, and the relevance of supportive social relationships which validate positive attributes of the individuals' personality, and help foster sense of identity and wellbeing (Kitwood, 1990, 1997; Kitwood & Bredin, 1992). Remembering autobiographical events from one's life is crucial to these processes. Studies have suggested that deficits in AM are related to weakened sense of self in AD (Addis & Tippet, 2004; Massimi et al, 2008), and that the negative impacts on wellbeing related to AM deficits are mediated by loss of identity in participants with varying severity levels of dementia (Jetten et al, 2010). Furthermore, reduced AM has a larger impact on self-rated life satisfaction in patients with mild dementia, compared to the impact on life satisfaction in those with severe dementia (Jetten et al, 2010), suggesting more self-awareness of memory issues influences their effect on wellbeing. This implies that it may be useful to target a deficit in AM in the early stages of dementia, or in people with aMCI. Thus, interventions that focus on recall of AMs related to preserving a sense of self, such as life review, are particularly relevant to aMCI patients. Life review is an intervention that acknowledges the unique experiences of the individual, emphasising the value of their life, and has been found to help maintain sense of continuity in people with memory difficulties (Haight et al, 2006) and, as discussed above in the 'depression' section above, improve mood in older adults with depression (Serrano et al., 2004).

Current study

In Chapter 3 it was found that Serrano et al's (2004) life review intervention was effective at improving AMS in healthy older adults. This particular method has previously been found to improve AMS and mood in depressed older adults (Serrano et al., 2004), whilst more traditional forms of life review help improve mood in people with dementia (Haight, Gibson, & Michel 2006). However, no studies to date have assessed the effectiveness of this particular life review programme which focusses exclusively on improving the known cognitive deficit in ability to recall specific AMs in a group of aMCI patients. We propose the use of this life review intervention with aMCI patients is particularly pertinent since they are a group at risk of progression to dementia and the associated deterioration in identity and wellbeing. There is a window of opportunity to improve AM specificity in this group contributing to maintenance of their psychological wellbeing since they still have relatively preserved ability to retrieve long term memories that foster a sense of self, compared to those in the later stages of dementia. Thus, the current chapter will test this life review method in a population of older adults with aMCI, with no diagnosis of dementia. This will help to distinguish whether improving specific AM recall in aMCI patients can enhance wellbeing via secondary effects on the factors related to autobiographical memory. These secondary effects may include protecting mental wellbeing and preventing depression, enhancing social functioning (in particular social problem-solving), and by contributing to functional independence in daily activities.

The life review intervention used in the current study was slightly adapted based on feedback from participants from Chapter 3. For example, healthy older adults who completed life review had commented that they would have liked to receive more homework activities. Therefore a diary activity was added to each homework task which involved writing down a 'specific memory of the day' every evening in order to improve the encoding of specific memories. This was an idea taken from the Memory Specificity Training programme (MEST; Raes et al, 2006). Since no effects were found at 3-month follow up in our previous study (Chapter 3; Leahy, Ridout, Mushtaq, & Holland, 2017), a six-week follow up was conducted instead and participants were given additional materials, i.e. further prompting questions and diary activities, at the end of the final intervention session so that participants could continue practice. Reduced AM has been shown to have the largest impact on life satisfaction in patients with mild symptoms (Jetten et al, 2010), therefore a measure of life satisfaction was also taken in this chapter in order to examine whether this would improve following life review. Since previous life review studies have found significant benefits in terms of life satisfaction (Serrano et al, 2004; Latorre et al, 2015), similar benefits were expected for participants in the current study.

In Chapter 3 it was hypothesised that there would be an improvement in mood in the life review group, which would be associated with increase in specific recall of positive events in particular due to the focus on positive appraisal within life review, and the positivity effect. However, this hypothesis was unsupported by the results in Chapter 3 since there was no change in mood and no difference between positive and negative specific recall. Previous research shows that older adults use cognitive control processes to enhance positive memories and diminish negative memories (Mather & Knight, 2005). It was proposed that the lack of effect on mood may have been explained by the generally high executive function of the healthy older adult sample, potentially masking any effect. Therefore, those with high executive control ability would have little room for improvement in the process of regulating the emotional content of memories. Additionally, it was found in Chapter 3 that people with lower baseline executive function had higher change scores in recalling specific positive memories. Therefore, these findings suggest that those with lower executive function (and proposedly less ability to regulate emotional material), may benefit the most from practice in accessing positive events during life review. The current study aimed to examine this theory by sampling a population likely to have executive deficits, i.e. older adults with aMCI.

Aims and hypotheses:

The main aim of this chapter was to examine the effectiveness of the life review intervention in older adults with Mild Cognitive Impairment with particular deficit in the domain of memory (i.e. amnestic type MCI). As in the previous chapters, the effect of the intervention on retrieval of specific autobiographical memories (AMs) and on secondary measures of factors related to AM and wellbeing were examined, relative to an active control group.

It was hypothesised that immediately following training, participants in the life review group would exhibit improvements in autobiographical memory specificity relative to the active control group, and that these effects would be maintained at 6-week follow up.

It was also hypothesised that the intervention groups would exhibit improvements on measures related to wellbeing: life satisfaction; depression; social problem-solving; and functional limitations relative to controls following training and at 6-week follow up.

Examination of relationships between changes in key variables is expected to reveal that changes in the wellbeing measures described above would be positively related to changes in specificity.

Life review focusses on practice recalling specific positive memories in particular, therefore it was hypothesised that improvement in AMS would be particularly prominent for positive events, compared to negative. Chapter 2 (Leahy, Ridout and Holland, 2018) found that older adults with low executive function at baseline improved the most in memory specificity. It was also found in Chapter 3 that older adults with low executive function at baseline who took part in life review improved the most particularly in memory specificity for positive events (Leahy et al, 2017). Since executive function is particularly impaired in aMCI it was hypothesised that baseline executive function would be also be related to change in specific recall of positive events in the current study.

4.2.Method:

4.2.1.Participants:

Although 99 people were screened, only 39 met the criteria for aMCI and were eligible. 39 participants aged 70+ with aMCI or probable aMCI took part in the study (Life review, n=20; Control, n=19). Demographic information of the sample after exclusions is displayed in Table 4.1. There were no significant differences between groups in demographics, $p>.05$ (see Table 4.1). Screening for aMCI was conducted according to criteria by Peterson (2004). This included:

- Self-reported subjective memory complaint or diagnosis of aMCI.
- Preserved general cognitive functioning, i.e. absence of dementia determined by ACE-III total score > 82 (Noone, 2015) and self or carer-reported absence of dementia diagnosis.
- Objective memory impairment- Age-corrected scaled score (age SS) on at least one of the following memory tests that is more than 1 standard deviation lower than the mean age SS: Logical memory and visual reproduction subsets of the Wechsler Memory Scales-IV (Weschler,2009); Rey's auditory verbal learning task (Schmidt, 1996).
- Essentially normal functional activities (ADL performance), but no more than 1 item on IADL to suffer changes.

Participants were excluded if they met the following criteria:

- Self (or carer-reported) presence of dementia diagnosis and objective indicator of presence of dementia (ACE-III< approx. 82).

- Terminal illness or have severe co-morbid health problems preventing their ability to participate.
- Self (or carer-reported) current diagnosis of stroke, traumatic brain injury, or substance abuse.
- Presence of severe major depression (indicated by HADS depression rating cut off >15 out of 21).
- Unable to communicate in English in order to understand task instructions adequately.

4.2.3.Randomisation:

All participants were assigned a number unique to them as part of their unique participant ID. Participant ID numbers were then randomly allocated to either the life review intervention or control group by the academic supervisor. Once the pre-intervention assessments were complete, the researcher was informed of the group allocation for each participant via a sealed envelope. A method of permuted block randomisation was used. Random numbers generated on an online pseudo-random number generator (Randomizer.org) were used to randomly select block size and permutation within block. Block sizes of four or six participants were used, e.g. if 'A' is life review group and 'B' is control group, for blocks of four, there were 6 possible permutations coded as 1= AABB, 2=ABAB, 3=ABBA, 4=BAAB, 5=BABA, 6=BBAA. For block sizes of 6 there were 20 possible permutations. Each number in one random number sequence selected the block size (i.e. odd numbers=block size of 4, even numbers= block size 6). Then each number in another random sequence selected the permutation of that block. This type of random allocation allows for a good balance among groups, and the use of random group sizes reduces selection bias as the investigator was blind to the size of each block.

Table 4.1. Participant demographics after exclusions by group type

		Life review group (n=20)	Control group (n=19)	Statistic	p value
Age	**Mean**	78.95	75.47	*F*=3.86	0.06
	SD	6.53	4.21		
Age when left education	**Mean**	18.05	18.95	*F*=0.75	0.39
	SD	3.22	3.14		
Gender (% within group type)	**Female**	45	42.1	X^2=0.03	0.86
	Male	55	57.9		
ACE-III at baseline	**Mean**	87.65	88.63	*F*=0.63	0.43
	SD	4.04	3.65		

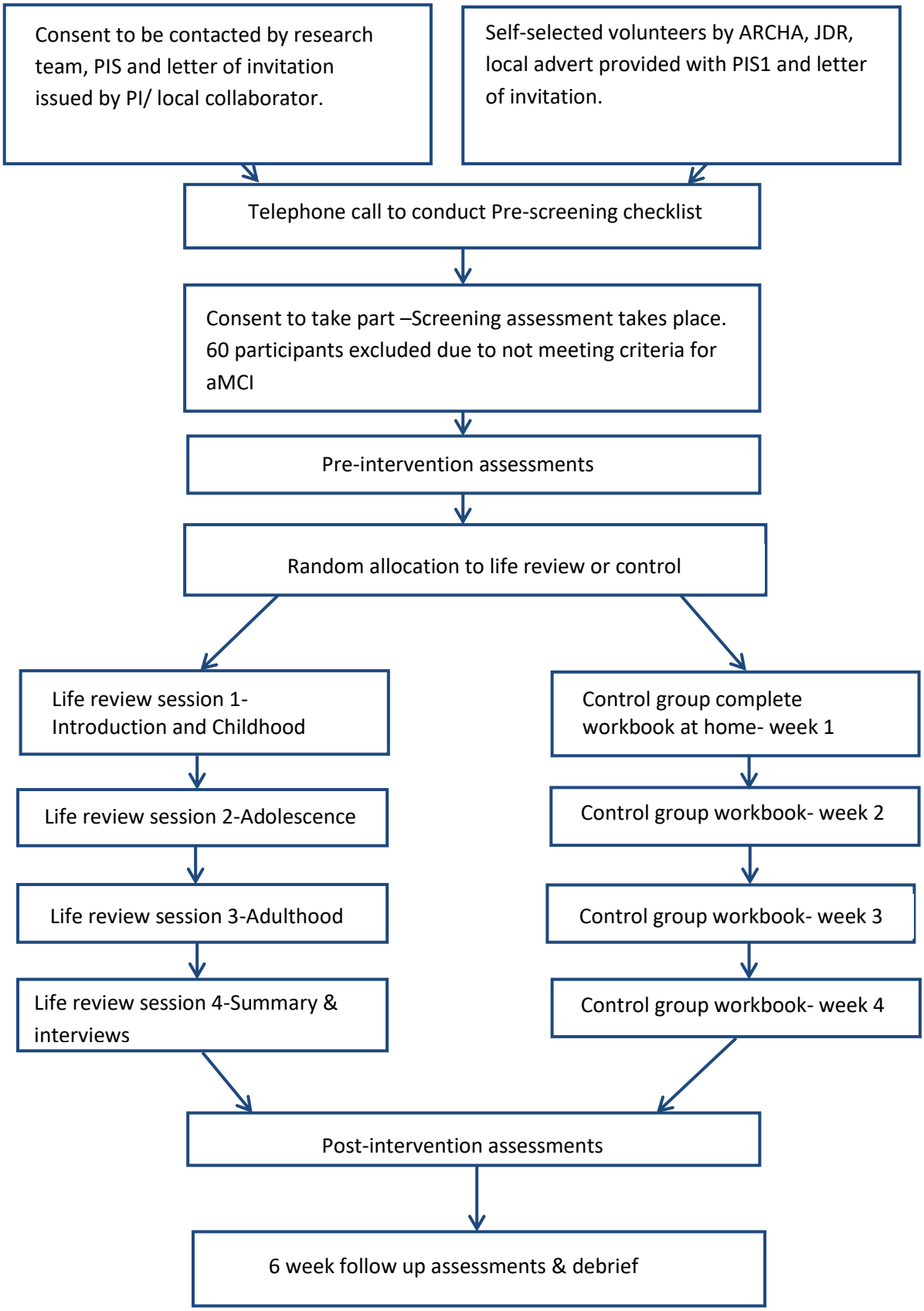
Participants were recruited though a number of sources: a geriatric clinic at Heart of England NHS Foundation Trust; a database of volunteers at Oxford Health NHS Trust; the Join Dementia Research online database; the University's participation panel for volunteers interested in healthy ageing research; older age focused organisations around the local area; participants who were screened out of the previous study in Chapter 3 (Leahy et al, 2017) due to possible cognitive impairment and had agreed to be contacted; and local advertisement in the community via posters. Study sessions took place ether in the participants' own homes or at Aston University. Participants received £7.50 per session at the University towards their travel expenses. Ethical approval was obtained from the Solihull NHS ethics Committee and the Health Research Authority (reference number: 17/WM/0003), with written informed consent being obtained from all participants.

4.2.2.Procedure:

Participants were screened by telephone or email for initial exclusion criteria. Following an initial face-to-face screening assessment for aMCI, participants were assessed on AM specificity, mood, social functioning, independence and executive function at pre- and post-intervention sessions and after a 6 week follow up period. Participants were randomly allocated between intervention and control groups (see Section 4.2.3 for randomisation procedure). The intervention consisted of 4 x 1 hour one-to-one weekly sessions, whilst the control group were given a workbook containing sustained attention tasks to complete at home over the course of 4 weeks (see Section 4.2.4: 'Control group workbook'). Participants

in the life review group were also invited to an interview to discuss their experience of the intervention (see Chapter 5). See Figure 4.1 for flow chart of study procedure.

Figure 4.1. Flow chart of study procedure



Key: PIS=Participant Information Sheet; PI=Principal Investigator; ARCHA=Aston Research Centre for Healthy Ageing; JDR=Join Dementia Research; aMCI=amnestic Mild Cognitive Impairment.

4.2.4.Materials:

Materials to screen for aMCI (see 'participants' Section 4.2.1. above for criteria):

Cognitive function: The Addenbrooke's Cognitive Examination-III (ACE-III; Hsieh et al, 2013) as used in the previous chapters. Here this was used as a measure of general cognitive function and to screen for potential dementia.

Self-rated depression: The Hospital Anxiety & Depression Scale (HADS; Zigmond & Snaith, 1983) as used in the previous chapters. Here this was used to screen for severe major depression >15.

Memory function: Wechsler Memory Scales-IV (Weschler, 2009): Logical memory subtest as a measure of story recall, and visual reproduction as a measure of visual learning and memory; Rey's auditory verbal learning task (Schmidt, 1996) as a measure of verbal memory. These were used to confirm an objective memory impairment (age-corrected scaled score on at least one memory test > 1 standard deviation lower than the mean).The logical memory subtest involves both immediate and delayed recall of two short stories. The visual reproduction subtest involves both immediate and delayed reproduction of a series of diagrams. Rey's auditory verbal learning task involves several trials of recalling a list of words, followed by one delayed recall trial and a recognition task.

Independence: Instrumental & basic activities of daily living (IADL, ADL) (Lawton & Brody, 1969; Katz et al, 1963) as used in the previous chapters, and the recreation, social, alertness and communication subscales from the functional limitations profile (FLP)(Pollard & Johnston, 2001). The IADL was used to screen for normal everyday functioning (no more than 1 item on IADL to suffer changes).

The above measures of general cognitive function, self-rated depression, and independence were conducted at pre, post-intervention and follow up in order to examine change in these variables, in addition to the variables below. The memory function tasks were only conducted once at the beginning of the study in order to screen for aMCI.

Additional measures at pre, post and follow up:

Autobiographical specificity: The Autobiographical Memory Test (AMT; Williams & Broadbent, 1986) was used following the same procedure described in the previous

chapters, except that in this study the instructions were repeated for each cue word as a reminder, e.g. the researcher said “Can you recall a specific event the word ‘happy’ reminds you of?” for each cue word, in addition to giving full instructions at the beginning (as described in Chapter 2). This was in order to make it more suitable for older adults with aMCI by accounting for potential difficulties remembering the task instructions. By presenting each cue with the instruction above, it was expected to provide a clearer measure of ability to recall specific memories, rather than a measure of ability to remember the instructions. Participants’ first responses were scored. Three alternative sets of ten cue words were also used in this study so that different words were used for each assessment and these were counterbalanced (See Appendix 5). In order to assess inter-rater reliability of this measure, a member of the research team who was blind to group type and time of assessment scored a random sample of 120 memories. Inter-rater reliability for specific vs general was calculated as Cohen’s Kappa=0.87 with a percentage agreement of 94%.

Social problem-solving ability: Means End Problem-Solving Procedure (MEPS; Platt & Spivack, 1975) as used in the previous chapters. Twelve problem scenarios were developed based on those used in Dennis, Astell and Dritschel (2012) so that three alternative sets of four scenarios (see Appendix 2) were presented for each assessment and these were counterbalanced. A random sample of 48 problem solutions (24 from the life review group, and 24 from the control group) were rated by an independent rater who was blind to group type for the purpose of analysing inter-rater reliability. The intra-class correlation coefficient was 0.85 for number of relevant means, and 0.79 for effectiveness ratings.

Executive function: Phonemic & category fluency (this is taken from a subscore of the ACE-III), and the random number generation task (RNG; Towse & Neil, 1998), the redundancy (R), adjacency (combined), and random number index (RNG) scores were calculated as in the previous chapters.

Working memory capacity: In the forward and backwards digit span task (Weschler, 1997) participants are read aloud a series of digits increasing in length and participants have to recall them in the correct order. Total scores give the summed number of correct trials from both the forward and backward tasks (0-30). The same sets of digits were used at each time point.

Life satisfaction: Satisfaction with life scale (SWLS; Diener et al, 1985). This scale consists of 5 statements about participants’ self-reported life satisfaction, e.g. “In most ways my life is close to my ideal”. Participants are required to rate their agreement with each statement from 0 (Strongly disagree) to 7 (Strongly agree).

Life review intervention (Serrano et al, 2004):

The life review intervention followed the same procedure as that used in Chapter 3 except there was an additional homework task each week, i.e. a 'memory of the day' activity whereby participants were asked to keep a diary of specific memories for each day in the week between face-to-face sessions. This was included as participants in Chapter 3 commented that they would have liked more homework. Participants were also provided with additional materials, i.e. further prompting questions and diary activities, at the end of the final intervention session so that participants could continue practice and potentially extend the effects at follow up.

Control group workbook:

The workbook consisted of 8 cognitively stimulating activities that are not related directly to autobiographical memory. These activities consisted of paper and pen sustained attention tasks, for example, participant were instructed to cross out all the telephone numbers starting with a certain area code, with a certain symbol next to it (see Appendix 9). Sustained attention is thought to be an area relatively spared in aMCI (Perry & Hodges, 1999). Participants in the control group were asked to complete this workbook at home over the course of 4 weeks (i.e. two activities per week).

4.3.Results

Baseline performance:

There was a significant difference at pre-training in digit span between groups, with the control group having higher digit span than the life review group, $t(36)=2.12$, $p=.041$. There were no other significant differences between groups at baseline on any of the other measures, $p>.1$ (see Table 4.2).

Table 4.2. Means and standard deviations of all relevant variables at pre-training, post-training and 6-week follow-up.

		Pre-training mean & SD		Group difference at baseline		Post-training mean & SD		6-week follow up mean & SD		3 (time) x 2 (group) interaction	
Variable		**Life review (n=20)**	**Control group (n=19)**	**F Statistic**	**p value**	**Life review (n=20)**	**Control group (n=19)**	**Life review (n=18)**	**Control group (n=19)**	**F Statistic**	**p value**
AMT-pS	**Mean**	0.62	0.68	F=0.74	0.395	0.65	0.69	0.7	0.69	F=.63	0.538
	SD	0.28	0.21			0.28	18	0.22	0.19		
AMT Positive-pS	**Mean**	0.6	0.66	F=0.43	0.518	0.67	0.68	0.72	0.69	F=0.69	0.504
	SD	0.32	0.28			0.28	0.2	0.27	0.22		
AMT Negative-pS	**Mean**	0.66	0.71	F=0.22	0.642	0.65	0.71	0.68	0.68	F=0.23	0.792
	SD	0.3	0.25			0.31	0.28	0.27	0.21		
MEPS No.Means	**Mean**	2.75	2.34	F=2.71	0.108	2.53	2.19	2.37	2.29	F=0.83	0.439
	SD	0.97	0.53			1.03	0.69	0.85	0.66		
MEPS Effectiveness	**Mean**	4.09	3.64	F=1.7	0.201	3.95	3.45	3.91	4.04	F=2.82	0.067
	SD	1.16	1.02			1.05	1.1	1.44	0.91		
SWLS	**Mean**	24.05	23.08	F=0.16	0.694	24.25	25.63	26.12	24.37	F=1.59	0.212
	SD	7.1	8.19			7.97	6.92	6.01	7.13		
HADS depression	**Mean**	5.15	3.95	F=1.3	0.262	4.37	3.58	5.12	4.26	F=0.19	0.824
	SD	3.54	3.01			2.91	3.11	3.24	3.74		
FLP total	**Mean**	228.85	192.89	F=2.03	0.162	221.55	199.16	207.41	192.11	F=0.22	0.806
	SD	87.87	67.67			70	71.78	94.52	91.44		

Key: AMT-pS=Autobiographical Memory Test Proportion Specific; AMT Positive-pS=Proportion of specific positive memories recalled; AMT Negative-pS= Proportion of specific negative memories recalled; MEPS=Means End Problem-Solving procedure; SWLS=Satisfaction With Life Scale; HADS=Hospital Anxiety Depression Scale- Depression subscale; FLP=Functional Limitations total score.

Measures from the current sample of older adults with aMCI were compared to the sample of healthy older adults from Chapter 2 in order to examine whether the aMCI sample were more impaired as would be expected (see Table 4.3 for means and S.Ds). The sample from Chapter 2 was selected as a comparison in order to reduce violation of the assumption of homogeneity of variances since it was an identical sample size to the current study. A one-way ANOVA revealed that baseline verbal fluency scores were significantly higher in the healthy sample than the aMCI sample, $F(1, 76) = 16.09$, $p < .001$. HADS depression ratings were significantly higher in the aMCI than in the healthy sample, $F(1, 76) = 5.55$, $p=.021$. There were no significant differences between the samples in autobiographical memory specificity or any of the other measures of executive function, $p>.05$. This is possibly due to the aMCI sample using strategies to compensate for their impairments, therefore masking any effect on measured tasks. For example, part of the characterisation for aMCI is that patients are able to function with little interference to their daily life because they are able to compensate for their difficulties (Knopman & Peterson, 2014).

Table 4.3. Participant demographics for current aMCI sample and healthy sample from Chapter 2

		aMCI sample (n=39	Healthy sample (n=39)	Statistic	p value
Age	**Mean**	77.18	75.59	F=1.67	0.201
	SD	5.65	5.22		
No.Years in education	**Mean**	18.5	18.69	F=0.07	0.792
	SD	3.17	3.22		
Gender (% within group type)	**Female**	43.6	61.5	X^2=2.52	0.112
	Male	56.4	38.5		
ACE-III total	**Mean**	88.13	94.87	F=77.76	<0.001*
	SD	3.84	2.84		
verbal fleuncy	**Mean**	10.77	12.28	F=16.09	<0.001*
	SD	1.93	1.36		
RNG	**Mean**	0.26	0.26	F=0.04	0.853
	SD	0.12	0.05		
R	**Mean**	2.09	1.55	F=2.97	0.089
	SD	1.46	1.33		
Adjacency	**Mean**	24.49	28.95	F=3.49	0.066
	SD	11.1	9.96		
AMT-pS	**Mean**	0.65	0.65	F=0.00	1.000
	SD	0.25	0.21		
AMT Positive-pS	**Mean**	0.63	0.67	F=0.32	0.572
	SD	0.3	0.24		
AMT Negative-pS	**Mean**	0.68	0.63	F=0.8	0.373
	SD	0.27	0.25		
HADS depression	**Mean**	4.56	3.09	F=5.55	0.021*
	SD	3.31	2.08		

Key: ACE-III= Addenbrooke's Cognitive Examination-III; RNG=Random Number Generation; R=Redundancy; AMT-pS=Autobiographical Memory Test Proportion Specific; AMT Positive-pS=Proportion of specific positive memories recalled; AMT Negative-pS= Proportion of specific negative memories recalled; HADS=Hospital Anxiety Depression Scale- Depression subscale.

Missing data:

For one participant (p012), data is missing for all measures at 6-week follow up, for the ACE-III and HADS at post-training, and for the digit span, AMT-Positive-pS, or AMT-Negative-pS at all three time points. All other data for the first two time points from this participant were included (i.e. MEPS, RNG, total AMT-pS, SWLS, ADL, IADL, FLP).

Adherence to intervention:

All participants in the life review group attended every intervention session. In the control group, participants completed between 89 to 100% of the workbook (mean proportion of workbook completed=0.99, SD=0.03).

Analysis of primary outcome (autobiographical memory specificity):

A 2 group (Life review and Control) x 3 time (Pre, post-training, and 6-week follow up) mixed factorial ANOVA was conducted with the proportion of specific memories on the AMT (AMT-pS) as the dependent variable. Statistics are displayed in Table 4.2. There was no statistically significant interaction between group and time on AMT-pS, $p>.1$, and no main effects of time or group type on AMT-pS, $p>.1$. Therefore, the hypothesis that participants in the life review group would exhibit improvements in autobiographical memory specificity relative to controls at post-training and at 6-week follow up was unsupported.

Scores were also calculated separately for proportion of specific memories recalled in response to positive cues (AMT Positive-pS), and to negative cues (AMT Negative-pS). The effect of cue valence was examined using a 2 (positive and negative) x 3 (pre, post-training, and 6-week follow up) x 2 (life review and control) ANOVA. However, there were no main effects of cue valence or interactions with cue valence, $p>.1$. Therefore, the hypothesis that that improvement

in AMS would be particularly prominent for positive events, compared to negative, was unsupported.

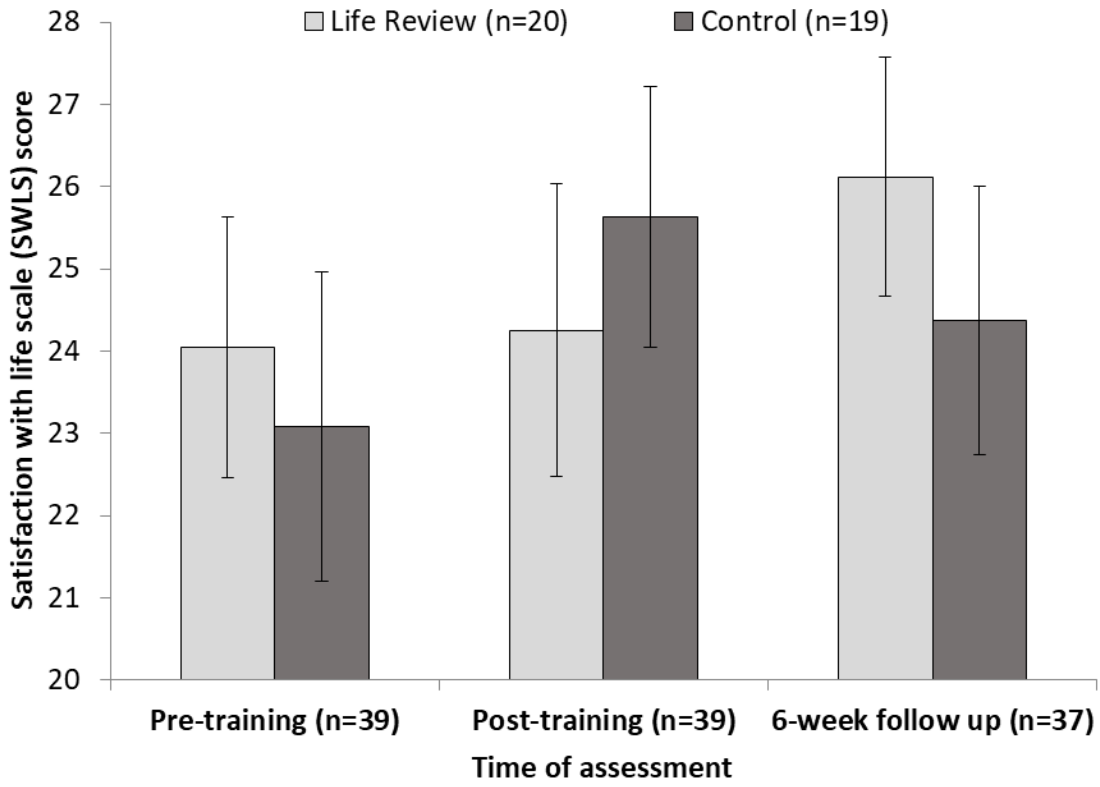
Analysis of secondary outcome measures:

A series of 2 group (Life review and Control) x 3 time (pre, post-training, and 6-week follow up) mixed factorial ANOVA were conducted with the following dependent variables: life satisfaction (SWLS); depression (HADS); social problem-solving (MEPS); functional limitations (FLP); executive function (RNG index, Redundancy, Adjacency); and working memory capacity (digit span), in order to determine the effect of life review on these secondary measures (see Table 4.2 for statistics).

Life satisfaction:

There was no statistically significant interaction between group and time on life satisfaction scores (SLWS), p>.1, and no main effects of time or group type, p>.1. The hypothesis that there would be an improvement in life satisfaction scores in life review participants relative to controls was thus unsupported. There was a marginally significant quadratic contrast for the interaction between time and group type, $F(1,35)=3.78$, $p=0.06$, $\eta p^2=0.097$. The mean values (see Table 4.2) suggest that whilst mean SWLS (life satisfaction scores) increased from pre-training to post-training, and from post-training to 6-week follow up in the life review group, there was a curvilinear relationship in the control group with mean SWLS increasing at post-training, and decreasing at 6-week follow up (see Figure 4.2).

Figure 4.2. Satisfaction with life scale scores (SWLS) at each time point in each group. Error bars represent +/- 1 standard error of the mean



Depression:

There was no statistically significant interaction between group and time on depression ratings (HADS), p>.1, and no main effects of time or group type, p>.1. Therefore, the hypothesis that participants in the life review group would exhibit improvements in depression ratings relative to controls was unsupported.

Social Problem-solving:

On the measure of MEPS number of means there was no statistically significant interaction between group and time, p>.1, and no main effects of time or group type on AMT-pS, p>.05. On the measure of MEPS effectiveness rating there was no statistically significant interaction

between group and time, p>.05, and no main effects of time or group type on AMT-pS, p>.1.Therefore, the hypothesis that participants in the life review group would exhibit improvements in social problem-solving relative to controls was unsupported.

Functional limitations:

There were no statistically significant interactions between group and time on total functional limitations (FLP), or any of the subscores of the FLP, p>.1, and no main effects of time or group type, p>.1. Therefore, the hypothesis that participants in the life review group would exhibit improvements in functional limitations relative to controls was unsupported.

Relationships between changes in variables:

As in previous chapters, change scores were calculated for each measure by taking the difference between scores at 6-week follow up and pre-training. Correlations between change in total AMT-pS and change in the following: Life satisfaction scores (SWLS); MEPS (number of means and effectiveness rating); HADS depression ratings; and FLP total scores, were first analysed with each group separately (Life Review, n=20; Control group, n=19). All variables reported were normally distributed as assessed by Shapiro-Wilk's test, p > .05. In the life review group change in MEPS number of means was positively correlated with change in total AMT-pS, r=0.63, p=.005. In the control group change in MEPS effectiveness ratings was positively correlated with change in total AMT-pS, r=0.5, p=.031. There were no other significant correlations between changes in AMT scores and changes in any of the other variables in each group separately, p>.05. Therefore, the hypothesis that changes in secondary measures would be positively related to changes in specificity was supported in terms of social problem-solving. However, this hypothesis was not supported for any of the other secondary measures.

The above analysis was also conducted in the whole sample (N=39).Change in life satisfaction scores were not normally distributed and therefore Spearman’s rho correlation coefficient were examined for relationships with this variable. All other variables reported here were normally distributed, as assessed by Shapiro-Wilk's test, p > .05. Results revealed significant positive

correlations between change in total AMT-pS and change in MEPS number of means r=0.42, p=.01, and between change in AMT-pS and change in MEPS effectiveness ratings, r=.35, p=.033, further supporting the hypothesis that changes in social problem-solving secondary measures would be positively related to changes in specificity was supported. There were no other significant correlations between changes in AMT scores and changes in any of the other variables in the whole sample (n=39), p>.05.

Executive function:

Correlations between baseline executive function measures and changes in total AMT-pS, AMT Positive-pS and AMT Negative-pS were examined in the whole sample (n=39) in order to assess the hypothesis that baseline executive function would be related to change in specific recall of positive events in particular. The redundancy score (R) variable was not normally distributed, therefore Spearman's rho correlation coefficients were examined for relationships with this variable. All other variables reported were normally distributed as assessed by Shapiro-Wilk's test, p > .05. Results revealed no significant correlations between baseline executive functions and change in AMT-pS, AMT Positive-pS, or AMT Negative-pS, p>.1.

The above analyses were also conducted for each group separately (Life Review, n=20; Control group, n=19). The redundancy score (R) variable was not normally distributed in the life review group, therefore Spearman's rho correlation coefficient were examined for relationships with this variable in the life review group. In the life review group there were no significant correlations between baseline executive function and changes in total AMT-pS, AMT Positive-pS or AMT Negative-pS, p>.05. In the control group there was a significant positive correlation between baseline digit span and change in total AMT-pS, r=0.47, p=.042, and between baseline digit span and change in AMT Positive-pS, r=0.54, p=.018. This partially supports the hypothesis that baseline executive function would be related to change in specific recall of positive events in particular, but this was only confirmed in the control group.

Additional analyses:

Exploratory analysis was conducted to examine whether there were any differences between those who improved their AMS scores, and those who did not, in order to ascertain who may be most likely to benefit. The sample was split into two groups: Improvers were classified as those who had an overall positive change in AMT score ≥0.1, and non-improvers were classified as those who had an overall change in AMT score ≤0 (i.e. their AMS decreased or stayed the same). There were 16 participants who improved and 21 who did not improve out of the whole sample. From the life review group alone, there were 9 participants who improved, and 9 who did not improve. From the control group alone, there were 7 participants who improved, and 12 who did not improve. One-way ANOVAs revealed that there were no significant differences between improvers and non-improvers, either in the whole sample, in the life review group alone, or in the control group alone, in any of the following key variables of interest: age, age when left education, general cognitive function, executive function, working memory capacity, or depression, $p>.05$.

4.4.Discussion:

The aim of this chapter was to examine the effectiveness of life review in older adults with amnestic Mild Cognitive Impairment (aMCI) for improving autobiographical memory specificity (AMS) and associated measures of wellbeing. The first hypothesis that participants in the life review group would exhibit improvements in autobiographical memory specificity relative to controls at post-training and at 6-week follow up was unsupported as there were no improvements in the measure of AMS, and no interaction between time and group type. The lack of effect suggests that the intervention was not an effective method of improving AMS in older adults with aMCI, which is contrary to previous evidence from Chapter 3 that it is an effective method for improving AMS in healthy older adults (Leahy et al., 2017). This implies that the benefits of life review depend on the target population, and may only be helpful in older adults without any significant amnestic impairment. A comparison of people who did improve as opposed to people who did not improve in AMS was conducted in order to determine who may be likely to benefit, but there were no differences in the variables of interest between improvers and non-improvers.

A potential explanation for this could be that the sample in the current study had reduced learning potential to improve their recall of specific events due to their impairment. In support of this, when investigating an AM intervention (MemFlex) with healthy older adults in Chapter 2, practice effects were found in AMS even though the intervention was no more effective than the control activity. It was concluded that over-general memory was amenable to change. Thus, healthy older adults have the capacity to improve AMS. Whereas in the current study there was no main effect of time, showing there was no practice effect of participants completing the AMT on multiple occasions in either the life review or control group. People with aMCI are generally high functioning, independent, and their cognitive changes are only mild. They are still able to use compensatory strategies to overcome their memory difficulties, therefore abilities measured in an experimental setting do not always manifest in everyday life. Lack of practice effects can be an indicator of early difficulties in learning potential in people with MCI, which is a more sensitive measure than cognitive assessment on a single occasion. The apparent lack of potential to improve in AMS with practice in the current sample could therefore be a more sensitive indicator of the participants' difficulty with AM recall, compared to a one-off AMT score. This would explain why their baseline AMT scores were no different than the healthy older adults baseline AMT scores in Chapter 2. In support of this proposal that AMS may be a sensitive measure of change in aMCI, Donix et al (2010) suggest that further studies may investigate ABM task performance as an early diagnostic indicator for Alzheimer's Disease. The authors found that although older adults with aMCI had only subtle impairments in cognitive measures when compared to healthy controls, they had significantly reduced AMS. This suggests that deficits in aMCI may be more widespread than is observed in standard neuropsychological testing, and that AMS may be a more sensitive measure in this population which can detect problems more relevant to their everyday complaints.

The second hypothesis was that the life review group would exhibit improvements on secondary measures related to wellbeing at post-training and at 6-week follow up. The results do not support this hypothesis as there were no significant improvements in life satisfaction, depression, social problem-solving, or functional limitations. The reason improvements were expected on these measures is because they are linked to AMS. Since AMS did not actually

improve, this would explain why none of the related secondary outcomes improved either. The marginally significant quadratic contrast highlighted different patterns in life satisfaction between the groups and time points. The descriptive data suggested that in the life review group, life satisfaction increased across each time point, whereas in the control group, life satisfaction increased at post-training, and decreased at 6-week follow up. However, caution must be taken when interpreting this result since the interaction was not statistically significant and there were no significant changes across time in either group. It may be that with a larger sample size this difference in patterns would be magnified and could potentially show that life review could have more stable, longer lasting effects on life satisfaction relative to the control activity.

The third hypothesis that changes in the secondary wellbeing measures would be positively related to changes in AMS was supported in terms of social problem-solving, but none of the other secondary outcomes. The finding that changes in AMS and changes in social problem-solving from pre-training to 6-week follow up were positively correlated in this sample of older adults with aMCI is in line with our findings from healthy older adults for a relationship between these two variables. This provides support for the proposal that the episodic processes related to the medial temporal lobe in the brain, which is an area particularly affected by aMCI, underlie both recalling episodic details from the past, and simulating hypothetical solutions to ill-defined problems, such as social scenarios (Sheldon et al, 2015; Vandermorris , Sheldon, Winocur, & Moscovitch , 2013). Generating various alternative solutions is an essential skill for effective problem-solving (D'Zurilla & Nezu, 1980). Although there was no overall effect on social problem-solving, there was no effect on AMS either. If a strategy was developed that could improve AMS in aMCI, this relationship suggests it may also be a useful strategy for improving social functioning in people with aMCI. This has important implications since people with aMCI have performance deficits in daily routines particularly in social interaction-related activities (Reisberg, 2001; Reisberg et al., 2007), yet maintaining social relationships is critical for helping reduce the risk of dementia in this group who are already at high risk.

Our final hypothesis that improvement in AMS would be particularly prominent for positive events compared to negative was unsupported as there was no effect of cue valence in AMS

performance. Given that there was no overall improvement in total AMT scores it is unlikely that any changes would be large enough to detect a difference in valence. We also expected to replicate findings from Chapters 2 and 3 that low executive function at baseline would be positively related to change in memory specificity, and particularly to change in positive specific recall. In the sample as a whole there were no relationships between baseline executive function and change in total AMS, or in positive or negative AMS. When each group was examined separately there were no relationships in the life review group, but in the control group baseline working memory (digit span) was positively related to both change in total AMS, and change in positive specific recall. Although there was no effect of the intervention in the current study, this finding supports our previous suggestion that older adults with lower executive function improve the most in specific recall of positive events in particular, therefore specificity training may be particularly helpful for people with lower executive function. Although it was expected that the sample of older adults with aMCI would have lower executive functioning and lower memory specificity than healthy older adults, it was found that the aMCI sample only performed lower than the healthy sample (in Chapter 2) on one measure of executive function (verbal fluency). This could be due to older adults with aMCI using compensatory strategies to cope with executive changes, therefore attenuating the relationship with AMS. A stronger relationship between executive function and change in positive specificity may be expected in a more impaired sample, for example in older adults with Alzheimer's Disease. A measure of pre-morbid IQ level would also be beneficial in order to determine the extent to which individuals with aMCI had cognitively declined.

Although there was no significant difference in AMS between our aMCI sample and healthy older adults in Chapter 2, this could be due to the use of repeated instructions in the current study. Therefore, the lack of practice effects could indicate a potential difficulty in AMS which the AMT itself did not detect. In contrast to Chapter 2, in the current study instructions were repeated for each cue word as a reminder, i.e. the researcher said "Can you recall a specific event the word…reminds you of?" before each word, in addition to giving full instructions at the beginning. The purpose of this alteration was to ensure that the task would measure the aMCI participants' ability to recall a specific memory, and not simply the ability to remember the task

instructions. However, this is a potential limitation of the current study because it could have actually masked the over-generality effect by reducing the executive demands required in the task. Updating ability in particular has been evidenced as important to AMS (Holland, Ridout, Walford, & Geraghty, 2012). Therefore, by reminding participants of the instructions before each cue, this effectively reduced the load on the ability to update the task demands. Ford, Rubin and Giovanello (2014) argued that task instructions may influence the magnitude of the over-generality effect in older adults. They found that the age-related over-generality effect in conditions where participants are explicitly instructed to recall specific memories primarily reflected older adults' impairment in the maintenance and implementation of task instructions. It may be useful for future studies with aMCI populations to find a balance between ensuring an accurate, isolated measure of ability to recall specific memories whilst controlling for deficits in remembering task instructions, but without masking the effect of executive deficits on the process of retrieving specific memories.

It is suggested that the lack of improvement in AMS, either as an outcome of the intervention or via practice effects of completing the task used to measure AMS multiple times could be due to a deficit in learning potential in older adults with aMCI. Since this theory is speculative, the next chapter aims to investigate this and other potential explanations for the lack of effect by analysing participants' personal feedback during interview about their experiences of the intervention.

Conclusion:

The results of this study suggest that the life review intervention was not effective in improving autobiographical memory specificity or the associated secondary measures related to wellbeing in older adults with aMCI. This is in contrast to the effect of the life review intervention found in a sample of healthy older adults in Chapter 3. There were also no practice effects in the current sample, which is in contrast to findings from Chapter 2 conducted with healthy older adults. We propose that the lack of practice effect on AMS in the current study could be due to a reduced potential to improve recall of specific events in this aMCI sample, due to their cognitive

impairment. This implies that the lack of effect of the life review intervention may not be due to a problem with the intervention itself, but rather that the sample had reduced learning potential to improve their AMS. Another key finding was a relationship between change in AMS and change in social problem-solving. This further supports our previous findings in Chapters 2 and 3 that AMS is essential to social functioning. This is especially critical for older adults with aMCI since social functioning is a protective factor against cognitive decline and they are a group already at risk of progression to dementia.

Chapter 5- Thematic analysis of the experience of Life review to improve autobiographical memory for people with amnestic Mild Cognitive Impairment (aMCI)

5.1.Introduction:

A novel method of structured life review that focusses on improving autobiographical memory specificity (AMS) was developed by Serrano, Latorre, Gatz, & Montanes (2004) linking traditional reminiscence literature with cognitive literature on AM in order to strengthen empirical evidence for interventions. As discussed in Chapter 4, AMS is reduced in aMCI compared to normal ageing and is related to factors that contribute to wellbeing (e.g. social problem-solving, depression, independence, sense of self). This novel method has been shown to help improve AMS, depression ratings, and life satisfaction in older adults with depression (Serrano et al., 2004) and in healthy older adults as part of an active ageing programme (Latorre et al., 2015). It is thought to do this by enhancing access to positive memories and reducing access to negative memories (Latorre et al, 2015). In Chapter 3, this life review intervention was tested in comparison to Memory Specificity Training (MEST; Raes, Williams, & Hermans, 2009) in healthy older adults. Although there were no observed effects on depression ratings, qualitative feedback from participants in the life review group indicated they experienced a feeling of life satisfaction as a result of taking part in life review. The results of the qualitative analysis also suggested a benefit from recalling more personally meaningful memories related to the self in the life review group, compared to participants who completed MEST.

Amnestic Mild Cognitive Impairment (aMCI) can have a significant impact on social and mental wellbeing and has been associated with diminished quality of life (Barrios et al, 2013). In Chapter 4 quantitative measures were used to assess the effectiveness of a life review intervention on improving wellbeing in older adults with aMCI. However, the activity of reviewing one's past, or 'life review', is a natural process that occurs in older age as we approach the end of our lives. It involves reflecting on past experiences and unresolved conflicts, with the purpose

of integrating memories of the self in the past with the present, in order to frame a meaningful picture of one's life (Butler, 1963; Bluck & Levine, 1998). Considering the uniqueness of personal memories related to the self, this is likely to be a very subjective experience. Therefore, the outcomes used to measure the success of a life review intervention can vary widely. For example, previous studies have examined different outcomes and found that life review interventions increased self-esteem (Haight, Michel, & Hendrix, 2000), improved adaptation (Chiang, Lu, Chu, H, Chang, & Chou, 2008), and promoted ego integrity in older adults (Haight et al, 2000). Using qualitative methods to analyse individuals' accounts of the experience of life review can provide additional, valuable insight into the potential effects of such interventions. In the current study, a qualitative method was employed in order to corroborate, challenge, or cross-validate quantitative findings (Chapter 4) relating to the effectiveness and suitability of the life review intervention for people with aMCI.

In Chapter 4 the above life review intervention was examined in older adults with aMCI, based on the proposal that reduced AMS in aMCI contributes to reduced wellbeing. A quantitative measure of life satisfaction was incorporated into the study in Chapter 4 in order to investigate the benefit of life review to life satisfaction, which was implied in Chapter 3. However, although there was a marginal quadratic effect on life satisfaction suggesting that life satisfaction increased across each time point in the life review group, whereas in the control group life satisfaction increased at post-training, and decreased at 6-week follow up, this effect did not reach statistical significance and there were no effects on AMS or any of the other secondary measures related to wellbeing. This was in contrast to findings of an effect on AMS of the same intervention in healthy older adults (Chapter 3) and to findings of a practice effect in AMS if a different type of AM training (MemFlex) in Chapter 2. A potential explanation for the lack of quantitative effect in Chapter 4 could be due to a reduced potential to improve recall of specific events in the aMCI sample, due to their cognitive impairment. The aim of the current chapter was to add a qualitative component to the overall assessment of the usefulness of the life review intervention in aMCI. Participants' perceptions of the life review programme are important since they are likely to influence their adherence to the intervention, their level of engagement with the activities required, and the likelihood that they will continue to exercise the skills learned in their

everyday lives. Participants' reported experiences of the intervention also offer a valuable insight into how effective it may or may not have been and the reasons why, and how appropriate it was in addressing the populations' needs. Therefore, in the current chapter the subjective experience of participating in life review with a focus on AMS was examined using qualitative analysis. The main aim of this analysis was to assess acceptability of the life review intervention in a population of older adults with aMCI.

5.2.Method:

5.2.1.Participants:

The qualitative data was captured from the life review study reported in Chapter 4 (see Section 4.2.1. of Chapter 4 for details of participants). Ethical approval to conduct interviews was included as part of the same application as the study in Chapter 4 which was obtained from the Solihull NHS ethics Committee and the Health Research Authority (reference number: 17/WM/0003), with written informed consent being obtained from all participants. A maximum variation purposive sample (n=10) was selected from the whole life review group (n=20) in Chapter 4. Maximum variation sampling, sometimes called heterogeneous sampling, is a method whereby participants with diverse characteristics are selected in order to provide a small, but representative sample. Participants who have the most extreme values on a chosen set of variables are selected. This allows patterns to be identified that cut across a heterogeneous sample (Palinkas et al., 2015), thus representing wide range of perspectives. The variables of interest used for maximum variation sampling in the current study were age, general cognitive function (total ACE-III score), number of years in education, depression rating at baseline (HADS), working memory capacity at baseline (total digit span score including forwards and backwards), executive function at baseline (adjacency scores on the RNG task) and autobiographical memory specificity at baseline (total AMT score). At least one participant within the extreme values of each of these variables was selected, i.e. within the 10^{th} and 90^{th} percentiles of the total life review group whilst also ensuring equal numbers of each gender. Table 5.1 displays the variables of interest for the selected 10 participants. They were selected

based on having extreme values when examining the whole life review group from Chapter 4 (n=20), these values are highlighted in the table, i.e. they were below 10th percentile and above 90th percentiles.

Table 5.1. Participant values for each variable selected for maximum variation. Headings contain the range of values within the whole life review group (n=20).

Participant number	Gender	Age (70-90)	No. Years education (15-24)	Digit span (13-23)	HADS depression (0-12)	AMT Total score (0.1-1)	ACE-III total score (82-94)	Adjacency score on RNG task (9.52-47.5)
P029	F	72	15	16	6	0.7	82	25
P053	F	89	15	21	2	0.8	89	20.41
P054	F	73	21	17	0	1	94	21.05
P044	F	72	17	23	7	0.9	92	14.71
P036	F	71	18	16	4	0.7	89	9.52
P057	M	80	24	20	10	0.9	91	34.52
P031	M	83	24	17	6	0.6	90	39.62
P095	M	83	16	20	12	0.2	84	47.5
P068	M	79	15	13	1	1	82	12
P033	M	73	15	18	3	0.1	91	14.71

Key: Cells highlighted in pale grey were above the 90th percentile, and cells highlighted in dark grey were below the 10th percentile for the whole life review group from Chapter 4.

5.2.2.Procedure:

Semi-structured interviews were conducted at the end of the last life review session (see Figure 4.1 for study procedure). Participants had consented to be interviewed as part of the original consent process in Chapter 4. The questions asked aimed to capture information about the experience of participating in the intervention, including likes and dislikes, whether they felt it benefitted them in anyway, the difficulty level of the tasks, and the practicality of the delivery of the intervention (see Appendix 6 for interview schedule). Interviews lasted between 6-31

minutes and were recorded using a digital voice recorder. Audio recordings were then transcribed into text files.

5.2.3.Analysis:

A thematic analysis was conducted using Braun and Clarke's 6-phase guide in order to identify and examine themes from the interview data using a realist deductive approach. Using this method the aim was to provide a detailed account of the acceptability of life review by participants with aMCI, guided by the following research question: "Is the experience of participating in a life review intervention which targets AM specificity acceptable to older adults with aMCI?"

All interview transcripts were read, and re-read, to ensure familiarisation with the data and development of initial ideas for potential codes and themes. Initial codes were generated for each segment of text, ranging from one line to a whole paragraph. The codes were then reviewed and collated into potential themes in a recursive manner until a collection of candidate themes and sub-themes were identified. A semantic approach was employed to identify themes within the explicit, surface level meanings of the data, rather than going beyond what a participant had said to look for underlying meanings, as the alternative latent approach would do. These themes were then reviewed and refined by re-reading all the coded data extract related to each theme to check that they fitted the identified pattern. During this process some sub-themes were collapsed into broader themes and others were separated into new themes. At this stage a thematic map was produced and used as a reference to review each theme against the entire dataset to check that they accurately reflected the data set as a whole. Finally, themes were further refined and named considering the overall meaning of each theme (see Appendix 7 for final thematic map).

5.3.Results:

Thematic analysis resulted in six main themes being identified across the dataset: 1) Provided focus, 2) Social nature, 3) Challenging aspects, 4) Exploring negative memories, 5) Not helpful,

but enjoyable and interesting, and 6) Awareness of past. Pseudonyms were used in the transcripts where names were mentioned. See Appendix 8 for further examples of quotes from participants relating to themes in the transcripts.

Theme 1: Provided focus

A common experience shared by the group was that the intervention forced them to think back and extract memories that they may not have thought about for some time. Therefore, it brought memories to the forefront which had previously been present in the background, but not actively contemplated. Being asked a structured list of questions relating to specific events from defined periods of their life provided them with a narrow focus to pay attention to, and consequently draw out memories from. The activity of reminiscing on one's past was not a new experience as it was something participants did in their everyday lives anyway, but taking part in the intervention emphasised this natural process and helped them to enter a focussed mindset and encouraged stimulation of memories. This was generally a positive experience as it elicited mainly positive memories and helped focus the mind. One participant even reported that he had found it useful and had started practising recall when he was unable to sleep to help stop him ruminating on daily hassles or negative thoughts.

> "Well you know if you wake up 4 o'clock, as I almost always do…you have to find some other thing to do. You can read or you can think about something. You have to focus the mind because otherwise the mind wanders onto things that you don't want to think about. So focussing the mind on what it was like when you were 14 or 24 is, I find it keeps my mind on something rather than wander off to having to pay tax or having a speeding fine…"

> "No I quite enjoyed doing it. It's sort of stirred me to think about things that perhaps I haven't thought about for a while."

> "It made me realise how much I'd forgotten in a way, you know, 85 years is a long time and every waking hour there's something coming into your brain."

> "It is sort of thought provoking you, you sort of think of something and then after you've gone you think oh so and so I could have said that (laughs). But er yeah I found it sort of stimulated the memory a little bit, but erm I often sort of pick up a paper and you read about somebody that did something when they were younger and thought yeah well I did that as well, you know, but, you don't think of it as a, a special thing…it jogged the memory a bit"

> "Yeah well I've thought quite a lot about my past from the past few years anyway, so this just emphasised some of my memories and er forced me to think about them in an even more, more vividly and it was very positive because I like thinking about my past…as I said I had already started to think quite actively over the last year or two so this just sort of reinforced my feeling that I could enjoy thinking back about my past life."

Theme 2: Social nature

The social interaction element of recalling memories with the researcher was mentioned several times. Participants felt that having somebody ask them questions about their past motivated them to look back and provided an opportunity to recall and share personal memories, which they wouldn't usually have a reason to do. Therefore, participating in the life review intervention gave participants a purpose for recalling and sharing memories, and they enjoyed having somebody listen to these memories. Participants also then sometimes shared memories they had recalled during the intervention with friends or family members.

> "Cause' sometimes we've, the sort of things we've been talking about here, we've talked about to Jane and Billy or to other people haven't we? (looks at husband), you know it's sort of reminded us about things and you know we've spoken about them"

> "It's nice to have somebody who listens and seems to be understanding and appreciating and laughing in the right laces (laughs)…so it's actually been very nice to have somebody listening and to have a purpose."

> “In a way one is so, it is so unlike society to be able to just talk like you and I have... Er talking is interesting, and if I could ask you all those questions it would be very interesting for me as well.”

> “I mean it’s interesting to meet you and discuss these sort of things because, having led such an active life I’ve suddenly become quite insular.”

> “I mean before I met you I don’t really er, jotted down memories, maybe for my children er events, you know what happened when because they say “well Dad when did you and Mum split up” and er, or er “what happened?” And things like that so I’ve started jotting down things and I’ve found that I was quite enjoying it so this has just sort of reinforced the whole idea and it’s always been, yeah, yeah, it was definitely positive for me.”

Theme 3: Challenging aspects

The task of recalling specific memories from the past was considered by participants to be more challenging than they had expected. They found that differentiating memories of specific events lasting less than a day from more general periods of time very difficult. A pattern that emerged among participants’ account of why this was difficult was that memories of specific events mould into one over time. Although the period surrounding specific events is remembered, the exact day that something occurred is not remembered in great detail because the specifics were not important at the time. For example, the participants often talked about how “you just got on with it” and carried on with the routine of daily life, possibly without paying attention to specifics. Another aspect some participants found difficult was disentangling the timeframe of memories into confined life periods since each session in the intervention required them to recall memories from a defined period, e.g. childhood (0-12 years old), although this wasn’t viewed as a problem.

> “…sometimes I thought oh, I wish you hadn't constrained this, er, and the cut-off points and then er, childhood and teenage years, but erm, in fact it was quite interesting because it forced me to separate out different memories, different periods, so on

balance I think it was a good split… although one or two times I cursed and thought why has she.. And then I've thought when was that memory, was it the year before or the year after? But it probably doesn't matter whether it was the year before or after, the cut-off point because I couldn't quite remember anyway, so it was OK."

"…you get on with your life really…I've just plodded on with my life"

"Well yes again I've got no particular memories it was just living. Gone out in the morning went to work, came home, and, well I suppose it was before the days of Television probably. That's what it revolved around going to work and coming home again…Hmmm, there's nothing specific to remember."

"Yeah a lot of things in life, they're not a particular moment, its, you know when you say it's got to last less than a day, you know, it doesn't always do that, you know some things, you've got to, you can't always see how it started erm and then it sort of evolves into something…some things happen slowly and then it suddenly comes to you."

"Yeah it was difficult, when you just look at it, it looks so easy but it's difficult when you come to it because you just sit there and you look at the question and you think "I can't, I can remember it all but not one specific thing". Not the, everything seems to sort of mould into one, you don't find one specific thing in a day or in your life it all gets swallowed up within life itself."

"No it was just trying to remember things that had happened that you know, erm exciting things and that because nothing really exciting happened?"…but I think it was so regular, it wasn't a highlight or anything like that it was just a way of life and you just got used to it."

Theme 4: Exploring negative memories

Even though the questions used to prompt memories in the intervention were targeted at positive events, many participants recalled negative memories spontaneously. On the whole, the experience of life review remained positive for most participants. However, they suggested that it may not be suitable for people who have perhaps had a traumatic past or do not enjoy thinking about their past. One participant who had had a difficult upbringing did find the experience had prompted unpleasant memories to resurface which she had previously accepted. However, she still felt it was worthwhile overall and she did not feel she had any regrets about her life:

> "No. I'm not a very emotional person actually. I had a very hard upbringing you see up until, you know, I left home so I'm not emotional…No, no I mean I could look back and think oh if only I'd done this that and the other but I don't, I think my life is as it is, you know so, and I just get on with it everyday, try and do, you know, what I want everyday."

> "Yeah I think it could help other people probably more than me, because they'd have had a happier childhood, and have easier, happier memories to find. I was struggling with those, really struggling… Hmm, you know that made me think how awful my childhood had been, and where I'd just accepted it, so it did sort of show me that. And then I brought back to memory of my Dad apologising to me you know for not standing up for me and things…Yeah it was it was worthwhile, yeah."

The common phrase, "you just got on with it", mentioned under the previous theme was also relevant to this theme as participants described how they did not dwell on negative events, they had let go of these memories and carried on with life. The experience of recalling negative memories was also described as beneficial since it can be useful to recall challenging periods and remember how well they coped with struggles.

> "..it's been good to go back and revisit things even sad things really. And to remember happy times, and perhaps people who are no longer with us."

"I've lived through and seen some pretty nasty things so there's no shocks now really that can affect me…but erm you know I wouldn't wanna change it there's nothing in my life I would want to change"

"No I mean Betty my wife she had a not very nice childhood completely, erm, and I don't think she'd want to sit down and go through that, she's sort of shelved those now"

"..it may not be for everybody I think so obviously the person would have to be interested, erm, but yeah I'd definitely recommend it."

"Which is in some respects it's good it shows that I'm still a human being and not just a dried up old piece of paper (laughs)"

"this made me think a bit more about the bad moments, erm, if I'm honest, yeah some of your questions have been quite prodding so they've forced erm to think about some of the more difficult moments. Because even trying to think about happy moments you inevitably think about, you know what's been surrounding that or what have I done before that or after and things like that…But um, I've enjoyed that... as I said it's good to think about difficult moments, decisions er happy moments and so on and yeah…Yeah it was definitely positive for me…Thinking about both the good moments and the maybe the difficult ones and er how I coped or how I didn't cope, so yeah definitely positive."

Theme 5: Not helpful, but enjoyable and interesting

Although participants did not seem to find the intervention personally helped them in any way, there was a prevalent theme that participants found it enjoyable because it was interesting and they were glad to have the opportunity to contribute to memory research.

"No, if I'm truthful it didn't help me at all"

"I found it very interesting. I'm somebody who likes to help people develop something and I'm very interested..."

"I've definitely enjoyed it, I don't think it has helped me but I suppose I think I'm a fairly sorted out person"

"I think the thing I really like about it is that it might, it might just be helping understand the problem."

"Yeah I mean if I was talking to someone I'd say yeah do it, you know I mean number one hopefully it helps some sort of research anyway, and it's quite interesting…"

"…yeah I enjoyed thinking about episodes of my past…I can't say it has (helped me) because I don't know, if it has it's not to my knowledge, maybe subconsciously it might have helped but I don't know."

Theme 6: Awareness of past

Looking back provided participants with a sense of awareness of their personal past, and sometimes a feeling of being fortunate for having had a good life. This awareness may have prompted consideration of regrets or a realisation they had no regrets, so that overall they found the whole experience to be enjoyable.

" Yes, yes I think yeah it's worthwhile, it certainly makes you (pardon me) makes you stop and think, and er, perhaps also appreciate what you have had and what you've got"

"Absolutely loved it, been looking forward to you coming…I'm just so pleased to be doing it, emotionally it has made me happy"

"The fact that you've brought this up and brought these type of questions is, is also helping me to realise that I am still alive and not just a walking dummy…it's brought

me back to realise I'm not just a stuffed old piece of flesh and blood, just walking around doing jobs, helping other people, I'm a person as well."

"I've thought well, there's more gone on in my life I think than I realised"

"…but I've never really looked back and thought oh I could have done that better."

"I was probably lucky because I had a very good past, but er, so it's been positive thinking about it"

5.4.Discussion

The life review intervention overall received mainly positive feedback and participants reported that it was an enjoyable, acceptable experience despite some challenging aspects. Although they did not report finding it personally helpful in terms of improving their memory or mood, there appeared to be a benefit of enhancing awareness of their past. The intervention provided a focus to their natural reminiscence of the past, bringing memories to the forefront. This was a pleasant and sometimes eye opening experience as participants recalled things they had forgotten about. Therefore, participating in life review gave them the opportunity to reflect and share memories about themselves in a social interaction with the researcher. A product of this intense focus on the past was that negative memories were also recalled spontaneously, leading participants to doubt how suitable the experience would be for people who have traumatic or adverse life histories.

The finding that participants did not feel that the intervention had helped them improve their memory or mood reflects the lack of quantitative effects on measures of AMS and measures related to wellbeing in Chapter 4. This may be explained by the suggestion that thinking back to the past was an activity participants would often do anyway, before taking part. The main goal of traditional life review is to reflect on positive memories relating to the self and unresolved

conflicts, and to integrate them into a positive picture of one's life. Since many participants had already begun to reminisce naturally, they may have already come to terms with any conflicts and they already had a fairly positive picture of their life. For example, they made comments that negative memories had already been 'shelved' or 'accepted', and as one participant commented she was already "a fairly sorted out person".

Neither were there any reported changes to their autobiographical memory specificity, as reflected by the lack of a quantitative effect on AMS in Chapter 4. Although a theme did emerge that participants found it difficult to discriminate specific episodes from general episodes (as they were being asked to do in the intervention activities), there were no themes about AMS being a problem in their everyday lives, or being something that they felt the need to improve. Only one participant reported that he thought that recalling specific memories was useful, and a skill that could be improved by practice. In contrast, the feedback surrounding the theme 'challenging aspects' suggested that participants found it very difficult to recall specific memories, and preferred to recall more general memories because important events in life often don't happen on a specific day, but rather they are formed over a period of time. Therefore, although participants did enjoy the experience, their personal motivation was to generally reminisce rather than focus on specific memories per se. Thus, improving their AMS ability was not a priority from their point of view. This is in line with Ricarte et al's (2011) view that older adults may recall more extended memories than specific because they tend to take a more integrative approach. Extended memories are thus recalled to facilitate structuring a coherent and continuous self. In other words, recollecting memories that occurred over a period of time but have more integrative meaning, as opposed to more specific detail, are more relevant to older adults. This supports the suggestion that flexibility between general and specific recall is also important, as discussed in the theoretical background in Chapter 2. For example, the type of memory most appropriate to achieving a goal depends on the task and recalling extended memories that have more integrative meaning is proposed to be more relevant to older adults (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002), possibly to help them fulfil the goal of finding meaning in one's life as they approach the end of it.

Nonetheless, by the nature of the intervention being directed at specific events, this provided a focus and stimulated memories they had not readily recalled before. For example, they described how the intervention helped access memories that had not been thought about for some time and brought them to the forefront. This is in line with the proposal that working memory is involved in AM retrieval (Ros, Latorre, & Serrano, 2010), as AMs stored in long term memory are retrieved and held temporarily in working memory, i.e. at the forefront of one's mind. Another outcome that emerged in the theme 'social nature' was that participating in the intervention gave participants a reason to take the time to look back on their past in more detail. Therefore, although participants reported they did not find the intervention helpful overall, it did facilitate retrieval of memories that they had not previously retrieved spontaneously, which they would likely not have been motivated to do had they not taken part in the intervention. This provided an awareness of more memories about themselves, and was an enjoyable and interesting experience.

The retrieval of negative memories was generally acceptable to most participants. Only one participant who had experienced an adverse childhood reported that she felt the intervention had reminded her how bad her childhood was, however she did say that it had been worthwhile overall. On the whole, retrieving negative memories was not problematic because participants had already accepted negative experiences. In some cases participants felt recalling negative memories was valuable since it reminded them of happy times with people they had lost, or it reminded them of how they had overcome problems. This finding supports the previous suggestion in Chapter 3 that participants were able to cope with negative recall during life review, and even view them from a positive perspective as the memories were within the context of one's whole life (Leahy, Ridout, Mushtaq, & Holland, 2017). This is in line with the proposal that older adults are more adept at reflecting positively on AMs and at drawing meaning from them (Singer, Rexhaj, & Baddeley, 2007). Given that participants reported they personally felt fortunate that they'd had a good life, and said they didn't think life review would be as suitable for people they know who had experienced more negative events, the background of the participant is worth considering before delivering this intervention. However, it is unlikely that somebody with traumatic or a negative life history would volunteer to participate in life review

knowing what it involves, unless they wanted to deal with those negative events and learn from them.

Part of the enjoyment of taking part in the life review intervention was the social interaction element as it gave participants a chance to not just recall, but share their memories with another person. They reported enjoying having somebody listen to these memories as it is not something they would usually discuss in any great depth with other people. Sometimes they later shared the memories they had recalled with friends or family. This supports the previous finding in Chapter 3 that older adults enjoyed the sharing element of AM interventions. The one-to-one interaction which takes place during life review may be influenced by speaker-listener characteristics, as similarities between the two are suggested to support the memory sharing process (Alea & Bluck, 2003). For example, a male older adult may be more likely to share more emotional memories with another male older adult, as opposed to a female younger adult. The social functions of AM are also affected by this, for example, an older person sharing a memory with a younger person may be motivated by the goal of teaching or informing the younger, less experienced listener, whereas sharing a memory with another older person may be motivated by the goal of facilitating empathy (Alea & Bluck, 2003). Therefore, it may be beneficial for future life review interventions to consider the influence of speaker and listener characteristics such as gender, age, familiarity on the one-to-one memory sharing process that occurs during life review.

A potential limitation of the current study is that the sample did not include all of the participants who took part in life review in Chapter 4 (n=20). However, efforts were made to ensure the sample selected was representative of the whole group by using a maximum variation purposive sampling technique. Furthermore, our sample size of n=10 was within guidance on sample size for small projects using thematic analysis which recommends 6–10 participants for interviews (Braun and Clarke, 2013). The suggestion that participants had started to naturally reminisce prior to taking part could be a result of a biased sample, i.e. the study might have attracted participants who were particularly interested in recalling their past as it was advertised as a study about recalling autobiographical memories. However, this would also be the case if life review was conducted in a real-life setting. Another potential limitation is that the interviewees all

met the criteria for amnestic Mild Cognitive Impairment (see Chapter 4 for criteria) and therefore all had memory problems. It is possible this could have affected their memory for the experience of the whole intervention which took place over 4 weeks. In order to reduce this risk the interviews were conducted immediately following the last intervention session, whilst it was still recent in their memory.

Conclusion

The experience of life review to improve AMS in older adults with aMCI was not perceived to be particularly helpful by participants, but it did provide a sense of awareness of their past. Participants found it enjoyable and interesting in terms of the social interactive element of memory sharing, and bringing happy memories to the forefront. All interviewees agreed it was worthwhile taking part. Although remembering their past was often not a novel activity, the intervention provided a focus and a motivation to extract memories that were stored a little deeper in the hierarchical AM system, i.e. at the specific level of retrieval. Therefore, the intervention was considered overall to be acceptable by this population, with some suggestions for improvements such as consideration of whether the prospective participant had experienced particularly negative events in their life.

Chapter 6: Discussion

6.1.Summary of aims and background

There is a wealth of literature on the importance of ability to recall specific autobiographical memories to wellbeing. For example, autobiographical memory specificity (AMS) is associated with vulnerability to psychopathologies such as depression (Sumner, Griffith, & Mineka, 2010) social problem-solving (Beaman, Pushkar, Etezadi, Bye, & Conway, 2007), sense of self (Ricarte, Hernandez-Viadel, Latorre, & Ros, 2012), and functional limitations (Holland et al, 2016). Reduced AMS, or over-general memory (OGM), occurs more frequently in older adults compared to younger adults. Evidence suggests this is likely to be due to the role of executive function on AM retrieval, which deteriorates with age, therefore affecting ability to recall specific AMS in later life (Piolino et al, 2010). Interventions designed to improve AMS and mood in depressed young and old populations have previously been found to be beneficial. However, there has only been little research into preventive interventions that aim to improve AMS in older adults who are not clinically depressed (Latorre et al, 2015).

As the population of older adults continues to grow, the gap between life expectancy and healthy life expectancy remains the same (Government Office for Science, 2016); therefore improving quality of life is an important objective of interventions for older adults. Preserving social functioning, preventing development of depression, and maintaining independence, which are also associated with cognitive decline and risk of dementia, are thus critical targets. AMS is a key cognitive ability used in everyday life that is related to all of these targets. This warranted further investigation into the development of interventions to improve AMS as a strategy to prevent decline in social and mental wellbeing in older adults. The aim of the current body of work was thus to investigate the use of previously developed methods of improving OGM associated with depression, for improving OGM associated with ageing. Contributing to the

development of a successful method of reducing OGM in older adults and improving our understanding of the mechanisms underlying this change could have significant implications for preventative healthy ageing strategies.

6.2.Principal findings:

Memory Flexibility training (MemFlex):

The aim of the first study in Chapter 2 was to examine an intervention which is in the provisional stages of development as a self-administered treatment for depression in younger adults, for use with a non-depressed older adult population. The intervention, titled MemFlex or Memory Flexibility training (Hitchcock et al, 2015), aimed to reduce automaticity towards recalling general memories, by improving cognitive flexibility between specific and general AM retrieval. This was based on evidence in the depression literature that OGM retrieval may not simply result from a lack of specificity, but due to a general difficulty in flexibly navigating the hierarchical AM store in depression (Dritschel et al., 2014; see Hitchcock et al, 2018). For specific memories in particular, reduced flexibility may result in perseveration on general memories, and a difficulty overcoming this to access specific memories, whereas general memories are more readily recalled as they are at the upper end of the hierarchical search process. Therefore, cognitive flexibility is proposed as an integral component to the retrieval of specific AMs. Since older adults also have a general difficulty in cognitive flexibility tasks (Taconnat et al., 2009), and reduced executive control is thought to underlie OGM in older adults, this novel intervention showed promise as a strategy to improve access to specific memories via enhanced flexibility of retrieval.

The results of Chapter 2 showed that AMS and the inhibition aspect of executive function improved in both the MemFlex group and a control group who completed a workbook of reading and activities related to healthy ageing. Although this did not confirm our hypotheses that MemFlex would improve more than the controls, it did suggest these abilities are amenable to change. It was likely that participants improved due to a practice effect of completing the tasks used to measure these abilities on multiple occasions. The implication of this is that a key skill,

AMS, which deteriorates with age but is important for everyday functioning, can be improved through practice. Previous AM training studies have found that targeted practice in recalling specific AMs helps to improve AMS, depression ratings and life satisfaction (Raes, Williams, & Hermans, 2009; Serrano, Latorre, Gatz, & Montanes, 2004). One of the potential reasons for the lack of effect of MemFlex compared to controls where other studies have succeeded may be the absence of a social element in MemFlex, as it is completed alone. Therefore, compared to other AM training studies which have involved either group or one-to-one activities, there was an absence of contextual and social cues in the MemFlex training that could facilitate AM recall. This is in line with Alea and Bluck's (2003) conceptual model of the social functions of AM, which highlights how the actual process of sharing personal memories with others, rather than simply thinking about them to oneself, is important to their functional use in everyday life.

The hypothesis that there would be improvements in secondary measures, i.e. social problem-solving, depression and functional limitations, was not supported as there were no significant changes in any of these items. The lack of change is likely to be due to floor and ceiling effects as the sample had low depression ratings and high independence scores at baseline. It may be useful for future studies to examine the effectiveness of MemFlex with a sample of clinically depressed older adults, they may be more likely to benefit as they would likely have more room for improvement on these measures. It was also unlikely that these secondary measures would change since AMS itself did not change and they were hypothesised to improve due to their relationship with AMS. There was, however, a relationship between the overall change in AMS from baseline to follow up and overall change in social problem-solving in the whole sample. This relationship provides further support for the constructive episodic simulation hypothesis which states that the same episodic processes underlying specific AM retrieval also underlie the process of generating solutions to social problems (Schacter & Addis, 2007; 2009). It suggests that if AMS can be improved via a training method, this would also have effects on ability to solve social problems, which is critical for maintaining social functioning.

Our examination of positive and negative specific recall in Chapter 2 did not find any evidence for the well reported positivity effect (Reed, Chan, & Mikels, 2014). However, there was a

significant increase in recall of specific negative, but not positive memories, across the whole sample. This supported our hypothesis that there would be a particular effect on negative memories compared to positive because the “positivity effect” protects positive memories from impaired specificity (Kwon, Scheibe, Samanez-Larkin, Tsai & Carstensen, 2009). This is further supported by our finding that people with the lowest inhibition ability at baseline benefitted the most in recalling specific negative memories in particular; reinforcing previous findings that specific positive recall is not influenced by reduced executive control in older adults (Holland, Ridout, Walford, & Geraghty, 2012). This protection of positive recall corroborates the proposal that preserved emotional processing in older adults provides an automatic route to specific positive memories, resulting in less demand on executive functions (Scheibe and Blanchard-Fields, 2009). The finding in Chapter 2 that inhibition was related to improvement in negative specific recall has implications for reducing depression. For example, a lack of inhibition of general memories in order to access specific memories can lead to generalisation and negative rumination processes associated with depression (Williams et al, 2007). However, there was no influence on mood in this sample who were not clinically depressed. Therefore, although it could be useful to train the inhibition element of flexibility in negative retrieval in those who are currently depressed, this may not be particularly useful in non-depressed older adults. MemFlex was originally developed for depressed younger adults, whereas previous AM training studies with depressed and non-depressed older adults had found a benefit to mood by targeting specific positive memories only. It was concluded that interventions for age-related OGM may well benefit from targeting positive memories instead of the executive processes associated with negative generalisation.

Life review vs MEST:

It was concluded in Chapter 2 that although executive function may be required for inhibiting general negative memories in order to access specific negative memories, the route to positive memories is more automatic. There was no effect on mood in Chapter 2 and it was suggested that the mechanism of reduced inhibition of general negative memories (which underlies OGM in depression) may not be a useful target in non-depressed older samples. By examining two

interventions in Chapter 3: one which purportedly provides systematic practice in AM retrieval which was hypothesised to have an impact on the underlying executive processes (i.e. MEST; Raes et al, 2009); and one which focuses on positive specific memory recall only (i.e. life review; Serrano et al, 2004), this Chapter sought to tease apart these underlying features of different AM training methods that account for their effectiveness. It was therefore examined whether improvements in memory specificity following MEST are related to concomitant changes in executive function, and whether the focus on positive AMs in life review accounts for its effectiveness via the proposed mechanism of strengthening positive recall and reducing negative recall. This would help to determine what may be the most useful approach for improving AMS and the associated factors related to wellbeing for a healthy ageing intervention, rather than as a treatment for depression which previous AM training methods have been based on.

The results of Chapter 3 confirmed our hypotheses that both the MEST and life review interventions were effective methods of improving AMS compared to a control activity (i.e. a workbook of cognitively stimulating puzzles) in a sample of healthy older adults. This expands on research with various other populations demonstrating the effectiveness of the MEST and life review programs to improve AMS (Raes et al, 2009; Neshat Doost et al, 2013; Moradi et al, 2014; Serrano et al, 2004; Latorre et al, 2015), to show a similar effect in healthy, independently living older adults. However, there was a lack of maintained effect after a 3-month follow up period. Participants were not asked to continue with the activities at the end of the intervention, so it is not surprising that there was a shift back to OGM. Qualitative feedback supported the suggestion that participants had not integrated the AM practice activities into their routine because they did not feel it was relevant or helpful to their everyday lives. Future studies may consider designing AM recall activities in a more ecologically valid context, for example, using hypothetical everyday situations to prompt recall as opposed to using cue words such as in MEST.

Similar to Chapter 2, there were no improvements in secondary measures in Chapter 3 either and this is again likely to be due to floor and ceiling effects. However, qualitative analysis of

feedback from the life review group indicated a beneficial impact on mood as participants reported a positive experience and feeling of life satisfaction. There was also a significant relationship between overall change in autobiographical memory specificity and overall change in social problem-solving in the intervention groups, reinforcing the same relationship found in Chapter 2. In addition to this relationship, in Chapter 3 change in AMS was negatively correlated with change in functional limitations, showing that people who improved the most in their AMS showed more reduction in limitations (i.e. improvement in function). This supports the previously suggested relationship between ability to recall specific autobiographical memories and functional limitations in older adults (Holland et al, 2017). An additional finding from the participants' feedback in Chapter 3 that reinforces the suggestions of Chapter 2 was the reported social benefit of the group format in MEST. Participants enjoyed sharing memories within a group and listening to others may have helped prompt their own memories. There may also have been an additional benefit of sharing memories with others from the same generation in MEST, rather than just with the researcher as they did in life review. This corroborates our suggestion in Chapter 2 and Study 2 of Chapter 3 that the activity of sharing memories with others, and similarity between speaker-listener characteristics may be important to the functional use of AMs (Alea & Bluck, 2003).

Another finding that was similar to the results of Chapter 2 was that people with the lowest inhibition ability at baseline showed the most change in specific recall. However, in Chapter 3 this was only in the life review group and was only for positive memories, as opposed to negative memories in the whole sample (MemFlex and control) from Chapter 2. This is not surprising considering that life review focussed only on practising positive recall. This implies that positive recall is not completely automatic and does require some inhibition of general positive memories. Together these findings confirm our hypothesis that people with lower executive function would benefit the most from AM training in terms of improving their ability to retrieve specific AMs.

In contrast to the life review group, there was no relationship between baseline executive function and change in AMS in the MEST group. The hypothesis that there would be an

improvement in executive function in the MEST group which would be related to change in AMS was also unsupported. This implies that the hypothesised underlying executive processes involved in AM retrieval which were being practised did not appear to improve on explicit measures of executive function, but there was a practice effect of MEST on AMS. Since the cue word activities in MEST are the same as the tasks on the AMT, it would be useful to include a parallel measure, such as the Sentence Completion for Events from the Past Tense (SCEPT; Raes, Hermans, Williams & Eelen, 2007) to confirm whether the effect of MEST in older adults is just a practice effect or whether it transfers to other measures.

The MEST group also reported that the negative recall involved was an unpleasant experience and they did not understand the purpose of it. As a result it is suggested that the inclusion of negative cue words in MEST with the aim of reducing bias towards negative memories, and to prevent them becoming over-generalised in depressed populations, is less justified in non-depressed older adults who reported that they did not dwell on negative experiences beforehand. The focus on enhancing positive specific recall in life review appears to be a more suitable approach for this population.

The findings from the qualitative component of Chapter 3 highlighted a difference between the MEST and life review methods. Whilst participants who did life review reported increased life satisfaction, MEST did not have a perceived effect on mood. Potential explanations for this include that in MEST it was difficult to relate personal events to isolated cue words that did not have any personal meaning to them, whereas in life review participants benefitted from recalling meaningful, personal events from their life that had value to them. Therefore, the recall activities in life review emphasised the overall value of their life, whilst the cue word tasks in MEST were not perceived to be valuable by participants. It was speculated that perhaps OGM in older adults represents vulnerability to depression for different reasons that it does in younger adults. In younger adults it is suggested that over-general memory mediates depression through increased rumination and experiential avoidance (Raes et al, 2006; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), but in older adults OGM may mediate depression by impairing the natural reminiscence process, preventing integration of past specific memories into a positive

meaning of one's whole life. This proposal is in line with previous research which highlights that "meaning-making" and integrative reminiscences are important therapeutic tools for psychological well-being alongside the recall and retelling of specific memories (Singer, Blagov, Berry, & Oost, 2013; Blagov & Singer, 2004; Thorne, McLean, & Lawrence, 2004; Afonso, Bueno, Loureiro, & Pereira, 2011; Wong & Watt, 1991). It would be worthwhile for future studies to examine this by analysing the integrative content of the memories retrieved during the life review sessions.

Life review in aMCI-Quantitative findings:

After the life review intervention was found to be the most suitable intervention with older adults in Chapter 3, the next phase sought to examine how useful it may be for those at high risk of cognitive and wellbeing decline. People with aMCI are highly likely to experience depressive symptoms (Lyketsos et al, 2002), and they are at a very high risk of conversion to dementia (Ravaglia et al., 2006). Therefore, early interventions are crucial for preventing decline in this group. Reduced AM has been associated with some of the psycho-social risk factors for cognitive decline, such as social functioning and depression, whilst AMS is even further deteriorated in aMCI compared to normal ageing (Murphy, Troyer, Levine, & Moscovitch, 2008). Chapter 4 therefore aimed to examine the effectiveness of the life review intervention at improving AMS in a sample of older adults with aMCI. Some alterations to the life review protocol were made based on the outcomes of Chapter 3 and previous literature. For example, a measure of life satisfaction was added, the homework tasks were extended to include a diary keeping exercise, the follow up period was reduced to 6 weeks, and participants were given additional materials at the end of the intervention so that they could continue practice.

The results of Chapter 4 indicated that the life review intervention was not an effective method in older adults with aMCI as there were no improvements in AMS in the life review group. When compared to the significant effect of the life review intervention on AMS in healthy older adults (Chapter 3), the results imply that the benefits of life review depend on the target population. Contrary to the results of the MemFlex study in Chapter 2 which found that OGM is amenable to

change in healthy older adults, there were no practice effects in the aMCI sample. One potential explanation for this is that the participants with aMCI had reduced learning potential to improve their recall of specific events due to their impairment. Lack of practice effects in people with aMCI can be an early indicator of difficulties. When comparing baseline AMS in healthy older adults to older adults with aMCI, the AMT did not detect any significant differences between these groups. This is unexpected as aMCI has previously been associated with deterioration in AMS compared to healthy older adults (Murphy et al, 2008). This is potentially a result of the addition of repeated task instructions for each cue word in the aMCI sample as a reminder. The aim of this was to ensure accurate measurement of AMS ability that would be unaffected by difficulty remembering task instruction in the aMCI sample, but it may have actually resulted in a masking of AMS difficulties. An alternative explanation is that participants with aMCI had reduced ability to improve AMS through practice, suggesting that reduced learning potential of AMS is a more sensitive measure in aMCI that can detect difficulties the standard AMT does not.

In terms of secondary outcomes, it was expected there would be more room for improvement on these measures since people with aMCI are more likely to experience symptoms of depression (Lyketsos et al, 2002) and have problems with social interaction-related daily routines at baseline (Reisberg, 2001; Reisberg et al, 2007). Unfortunately there were no significant improvements on these measures, however, since AMS did not actually improve it is not surprising that none of the related secondary outcomes improved either. The marginally significant quadratic contrast in the measure of life satisfaction suggested that life satisfaction linearly increased at follow up in the life review group, whilst in the controls it increased and then decreased again at follow up. It has previously been suggested that effects on depression symptoms may take some weeks to emerge after an AM specificity intervention because it allows time for the theoretical mechanisms underlying the relationship between AMS and depression to develop (Neshat-Doost et al, 2013). If this is also the case for life satisfaction, future investigation with a larger sample size may magnify this contrast and potentially show that life review can have stable, longer term effects on life satisfaction.

Our findings in Chapters 2 and 3 that changes in AMS and changes in social problem-solving were positively correlated were extended to a population of older adults with aMCI in Chapter 4. This relationship therefore appears to be very stable in providing evidence for the constructive episodic simulation hypothesis (Schacter & Addis, 2007; 2009). In aMCI this is especially important since the medial temporal lobe is an area of the brain particularly affected by aMCI and is thought to underlie both recalling episodic details from the past, and simulating hypothetical solutions to ill-defined problems, such as social scenarios (Sheldon et al, 2015; Vandermorris, Sheldon, Winocur, & Moscovitch, 2013). This relationship implies that if a more effective method of improving AMS in people with aMCI can be developed, this would be likely to have an effect on social problem-solving as well. A method for maintaining social relationships is a high priority for helping reduce the risk of conversion to dementia.

In Chapter 2 and 3 it was found that lower baseline executive function was related to increased change in AMS in healthy older adults. However, in Chapter 4 there was only a relationship between baseline digit span and change in AMS (and change in positive AMS) in the control group, but no relationships with executive function in either group. The digit span (including backwards and forwards) is a measure of working memory capacity rather than executive function. Although this supports the suggestion that working memory is involved in AM retrieval (Ros, Latorre, & Serrano, 2010), the hypothesis that people with aMCI who had lower executive function would improve the most in positive specific recall was unsupported in this study. It is possible that the relationship between AMS and executive function was attenuated because the executive function scores of the aMCI sample were not as poor as they were expected to be. Thus, those with aMCI may have been using compensatory strategies to cope with executive changes. This is not an uncommon finding as people with MCI are generally high functioning, independent, and able to rely on compensation strategies to cope with their difficulties. A stronger relationship between executive function and change in positive specificity may be expected in a sample that has more impaired executive function directly impacting on their everyday lives, such as in those with dementia.

Life review in aMCI-Qualitative findings:

Given that there were limited quantitative effects of the life review intervention with aMCI in Chapter 4, qualitative analysis of participants' own reported experiences of taking part in the intervention were able to offer a valuable insight. The process of recalling personal memories from across one's life is a very subjective experience; therefore the standard neuropsychological assessments employed in Chapter 4 may not detect some effects of the intervention described from the individuals' perspective. Chapter 5 aimed to address this by conducting thematic analysis of interview data collected from participants in the life review group to assess acceptability of the intervention to older adults with aMCI.

The majority of the feedback from participants was positive, suggesting the intervention was acceptable overall as it was an enjoyable and interesting experience. Although they did not report any specific benefits, reviewing their life history generally gave them an awareness of their past, sometimes leading them to feel fortunate and appreciative of their life. The quantitative finding that there was little effect on measures of wellbeing was reflected in the interview data as one of the themes was that participants did not find it particularly helpful. A potential explanation for this was that participants reported reminiscing on their past was not a novel activity, but rather something they had started to do naturally anyway before taking part. Thus, they may have already accepted any conflicts and had a positive picture of their life before beginning life review. However, one benefit of the life review intervention that emerged was that it provided focus which helped bring memories that had been in the background to the forefront. By asking participants to recall specific events lasting less than a day, this required participants to search deeper in the hierarchical retrieval of AMs, potentially necessitating more extensive use of their working memory to access deeper levels of specificity than they would usually recall naturally. This could explain the relationship found between baseline working memory and change in AMS found in the quantitative analysis of Chapter 4.

Participants also liked the social interaction element of the intervention. The process of sharing memories, rather than simply recalling them to oneself, was part of the reason the experience was so enjoyable. Having to retell episodes from their past in great depth and specificity was a unique experience that participants said they would not usually have cause for doing in their

everyday lives. Therefore, having somebody to listen and ask questions gave them the opportunity to explore their past selves. This corroborates the qualitative findings from Chapters 2 and 3 that sharing memories with others is important and possibly integral to the social function of AM (Alea & Bluck, 2003). The importance of a social element has been highlighted throughout this thesis, suggesting that more consideration of the social setting that the memory sharing process occurs in is warranted, for example, similarity between speaker-listener characteristics.

The finding of no effect of the intervention on AMS in people with aMCI in Chapter 4 was underlined by the theme of 'challenging aspects' in Chapter 5. Participants found it difficult to both discriminate specific episodes from general episodes and to confine memories to a particular life period, i.e. childhood (ages 0-13), adolescence (ages 14-20), etc. There may have been a lack of motivation to search for specific memories where general memories were more readily accessible. Participants did not feel the purpose of recalling specific events was a priority per se, but rather that it was enjoyable to generally reminisce. They described how important memories from one's life often do not happen on a specific day, but rather they are formed over a period of time. This reinforces Ricarte et al's (2011) view that older adults may recall more extended memories than specific because they tend to take a more integrative approach. One of the main functions of AM recall is to facilitate a coherent sense of self, and extended memories that occurred over a period of time may be more useful for this function. This supports the theoretical background for the MemFlex intervention because the type of memory most appropriate to achieving a goal depends on the task, therefore flexibility between general and specific recall is also important. For older adults, recalling extended memories that have more integrative meaning as opposed to detailed specific events may be more relevant to the goal of finding meaning in one's life as they approach the end of it. However, Donix et al (2010) compared specific, categoric and extended AM recall in older adults from three groups: healthy controls, aMCI, and Alzheimer's Disease (AD). They found that older adults with aMCI recalled fewer specific memories and more extended memories than the healthy controls, but no difference in the number of categoric memories compared to healthy controls. This suggests that the reported preference for extended memories in Chapter 5 may be more of a symptom of their

difficulties than a general preference for extended memories related to older age. It would be beneficial for future work to examine the integrative content of the autobiographical memories recalled voluntarily by people with aMCI, rather than memories recalled when being instructed to be specific as they were in the current research. This would help to clarify whether extended memories are preferred due to their integrative content.

A final theme was the experience of spontaneously recalling negative memories. Although the life review questions were aimed at positive recall, negative memories were often brought back inadvertently. This was generally acceptable to most participants as they commented that they had already accepted negative experiences and found the whole experience worthwhile. Some negative memories were even felt to be valuable because it reminded them of people they had lost or how they had coped with and overcome problems. This supports qualitative findings from Chapter 3 that participants had a strong perceived ability to deal with negative memories during life review, possibly because they were framed as part of a wider picture of their whole life. However, participants also suggested that it may not be a suitable intervention for people who have had a particularly traumatic past. Therefore, the selection of participants in future life review programmes may consider excluding those with traumatic memories. A different form of supported therapy with a trained counsellor may be better suited to help these individuals deal with past issues before embarking on life review.

6.3.Limitations and future directions:

In the first phase of this thesis a Memory Flexibility intervention (Hitchcock et al, 2015) was tested based on evidence in younger samples that depression is related to reduced cognitive flexibility and reduced ability to flexibly alternate between general and specific memories. It was suggested that difficulty in flexibly navigating the AM system may result in greater difficulty in accessing specific memories. It was proposed that since older adults have reduced cognitive flexibility and poor AMS as well, targeting flexibility may be beneficial. There was no effect of MemFlex on AMS or cognitive flexibility was relative to controls in the sample of non-depressed older adults. However, our findings did imply that the inhibition aspect of cognitive flexibility was

related to change in AMS. A limitation of this research was that the study only measured the executive functions that are assumed to underlie components of cognitive flexibility, and did not include broader measures of cognitive flexibility or a direct measure of ability to alternate between general and specific memories. However, the purpose of the current research was to assess methods of improving AMS, and one way of doing this was proposedly by improving flexibility in navigating the AM system in order to more readily access memories at the specific level. It would be beneficial for future work to establish whether there is a link between cognitive flexibility more broadly and AMS, and whether reduced AM flexibility is an underlying factor of reduced specificity in older adults.

Another limitation was the lack of social contact to guide participants through the MemFlex workbook. Level of social contact was also a limitation of the first study discussed in Chapter 3 because two different interventions were being compared with a control group (MEST, life review and control), but the social format of each was different (i.e. group, one-to-one and workbook). In order to overcome this limitation, a second smaller study was conducted examining MEST in the form of a workbook, rather than a group format (see Study 2, Chapter 3). There were no effects of MEST on AMS in a workbook format, which was in contrast to the beneficial effect of MEST on AMS in a group format. To our knowledge, this was first exploratory trial to examine MEST with older adults. Future work is required to assess whether MEST has superior effects on AMS in older adults compared to a control group who receive a similar level of social contact. Recently, however, an online version of MEST which participants complete individually was developed for depression (Martens, Onghena, Raes, 2018). This is similar to the workbook in Study 2 of Chapter 3 since it since it eliminates the social element of traditional group MEST (Raes et al., 2009), Initial findings suggest that whilst AMS improved after the first online MEST session, there was then a plataeu with no further linear increase (Martens, Onghena, Raes, 2018). Since the MEST workbook was not found to have an effect on AMS in healthy older adults (Study 2 of Chapter 3), this suggests the online version may not be useful for older adults either, however further analysis of online MEST with this population would help to confirm this. In addition, qualitative analysis in Chapters 3 and 4 indicated that the process of sharing AMs with others, whether one-to-one or in a group, was important. Thus, social interaction during the

memory sharing process, rather than simply practicing recalling memories alone, appears to be a key feature of AM training methods in determining their success. In order to capitalise on this, future AM interventions may benefit from considering other factors that influence the social setting in which the memory sharing takes place, such as the similarity between speaker and listener.

The final phase of the current research involved exploring the effectiveness and acceptability of the life review intervention in a group at particularly high risk of cognitive decline, i.e. older adults with aMCI. The theory behind this was that people with aMCI have reduced AMS, and AMS is related to factors that help prevent decline in cognitive function and wellbeing (i.e. social functioning and depression are both vulnerability factors for Dementia). Since there was no effect of the intervention (in contrast to significant effects of the same intervention in healthy older adults in Chapter 3) and no practice effects (in contrast to practice effects observed in a healthy older adults in Chapter 2), it was proposed that older adults with aMCI may lack potential to improve their AMS due to their amnestic impairment. The qualitative findings from this study suggested that although participants struggle to recall specific AMs, it is also possible they just prefer to recall more extended memories because these are more suited to the goal of achieving an integrated view of the self. Recent evidence supports that the mediating factors between specificity and depression differ with age (Ricarte, Ros, Serrano, Martínez-Lorca, & Latorre, 2016). Based on the qualitative feedback of the life review intervention in both Chapters 3 and 5 it is proposed that drawing meaning from memories to develop a coherent narrative may be particularly important for older adults. Future research is warranted to examine if over-general memory relates to poorer psychological wellbeing in older adults via reduced ability to connect detailed specific memories into a wider, positive narrative of one's whole life.

6.4.Conclusion

Previous AM training studies have examined the impact on depression in younger adults, depression in older adults, and more recently as a component of a program for active ageing in healthy older adults (Latorre et al, 2014). This thesis aimed to explore these existing techniques

in order to develop an intervention suitable for preventing cognitive and wellbeing decline in older adults. We have successfully demonstrated that OGM is modifiable in healthy older adults, but not in those with aMCI. Executive function was previously suggested to underlie AMS. We have demonstrated that older adults with low executive function or working memory function at baseline are likely to gain the most benefit in terms of reducing OGM. However, the element of meaning-making and taking an integrative approach is more relevant to older adults, suggesting that enhancing narrative coherence between memories is important as well as improving the executive function element of AM retrieval, i.e. the ability to reach specific levels of the hierarchical system. From this research we have discovered that framing AM practice in the context of a life review program appears to be the most suitable method for older adults. It is more likely to achieve engagement and adherence to the intervention as it is enjoyable. However, narrative coherence should be examined as a potential underlying mechanism that could be incorporated into the life review programme to enhance its' effectiveness. There was also a consistent relationship between AMS and social problem-solving in this thesis. This highlights the significance of older adults' ability to recall specific memories in helping to maintain social relationships. This has important implications as there is increasing evidence for the role of social engagement in protecting cognition.

References

Addis, D., & Tippett, L. (2004). Memory of myself: Autobiographical memory and identity in Alzheimer's disease. *Memory, 12(1),* 56-74.

Addis, D. R., Wong, A. T., & Schacter, D. L. (2008). Age-related changes in the episodic simulation of future events. *Psychological Science, 19(1),* 33-41.

Addis, D. R., Musicaro, R., Pan, L., & Schacter, D. L. (2010). Episodic simulation of past and future events in older adults: Evidence from an experimental recombination task. *Psychology and aging, 25(2),* 369.

Afonso, R. M., Bueno, B., Loureiro, M. J., & Pereira, H. (2011). Reminiscence, Psychological Well-Being, and Ego Integrity in Portuguese Elderly People. *Educational Gerontology, 37(12),* 1063-1080

Alea, N., & Bluck, S. (2003). Why are you telling me that? A conceptual model of the social function of autobiographical memory. *Memory, 11(2),* 165-178.

Amieva, H., Stoykova, R., Matharan, F., Helmer, C., Antonucci, T. C., & Dartigues, J. F. (2010). What aspects of social network are protective for dementia? Not the quantity but the quality of social interactions is protective up to 15 years later. *Psychosomatic medicine, 72(9),* 905-911

Amirkhan, J., & Auyeung, B. (2007). Coping with stress across the lifespan: Absolute vs. relative changes in strategy. *Journal of Applied Developmental Psychology, 28(4),* 298-317.

Anderson, R. J., Goddard, L., & Powell, J. H. (2010). Reduced specificity of autobiographical memory as a moderator of the relationship between daily hassles and depression. *Cognition & Emotion, 24(4),* 702-709.

Apostolo, J., Holland, C., O'Connell, M. D. L., Feeney, J., Tabares-Seisdedos, R., Tadros, G., . . . Cano, A. (2016). Mild cognitive decline. A position statement of the Cognitive Decline Group of the European Innovation Partnership for Active and Healthy Ageing (EIPAHA). *Maturitas, 83,* 83-93.

Armstrong, J. J., Mitnitski, A., Andrew, M. K., Launer, L. J., White, L. R., & Rockwood, K. (2015). Cumulative impact of health deficits, social vulnerabilities, and protective factors on cognitive dynamics in late life: a multistate modeling approach. *Alzheimers Research & Therapy, 7(1),* 38.

Bahro, M., Silber, E., & Sunderland, T. (1995). How do patients with Alzheimer's disease cope with their illness? A clinical experience report. *Journal of the American Geriatrics Society, 43*, 41–46.

Barclay, C. R. (1996). Autobiographical remembering: narrative constraints on objectified selves. In D. Rubin (ed), Remembering our past: studies in autobiographical memory (pp.94-125). Cambridge, Cambridge University Press.

Bárrios, H., Narciso, S., Guerreiro, M., Maroco, J., Logsdon, R., & De Mendonça, A. (2013). Quality of life in patients with mild cognitive impairment. *Aging & mental health*, *17*(3), 287-292.

Bartlett, F. C. (1932). Remembering: A Study in Experimental and Social Psychology.

Baumeister, R. F., Twenge, J. M., & Nuss, C. K. (2002). Effects of social exclusion on cognitive processes: anticipated aloneness reduces intelligent thought. *Journal of personality and social psychology, 83(4*), 817.

Beaman, A., Pushkar, D., Etezadi, S., Bye, D., & Conway, M. (2007). Autobiographical memory specificity predicts social problem-solving ability in old and young adults. *Quarterly Journal of Experimental Psychology, 60(9),* 1275-1288.

Bennett, D. A., Schneider, J. A., Tang, Y. X., Arnold, S. E., & Wilson, R. S. (2006). The effect of social networks on the relation between Alzheimer's disease pathology and level of cognitive function in old people: a longitudinal cohort study. *Lancet Neurology, 5(5),* 406-412.

Berna, F., Schonknecht, P., Seidl, U., Toro, P., & Schroder, J. (2012). Episodic autobiographical memory in normal aging and mild cognitive impairment: A population-based study. *Psychiatry Research, 200(2-3),* 807-812.

Berntsen, D., & Rubin, D. C. (2002). Emotionally charged autobiographical memories across the life span: The recall of happy, sad, traumatic, and involuntary memories. *Psychology and aging, 17(4)*, 636-652.

Birch, L. S., & Davidson, K. M. (2007). Specificity of autobiographical memory in depressed older adults and its relationship with working memory and IQ. *British Journal of Clinical Psychology, 46(2),* 175-186.

Blanchard-Fields, F., & Irion, J. C. (1988). The relation between locus of control and coping in two contexts: Age as a moderator variable. *Psychology and Aging, 3,* 197-203.

Blanchard-Fields, F., & Sulsky, L. (1991). Moderating effects of age and context on the relationship between gender, sex role differences, and coping. *Sex Roles, 25,* 645-660.

Blanchard-Fields, F. (2007). Everyday problem-solving and emotion: An adult developmental perspective. *Current Directions in Psychological Science, 16,* 26-31.

Blagov, P. S., & Singer, J. A. (2004). Four Dimensions of Self-Defining Memories (Specificity, Meaning, Content, and Affect) and Their Relationships to Self-Restraint, Distress, and Repressive Defensiveness. *Journal of personality, 72(3),* 481-511.

Blairy, S., Neumann, A., Nutthals, F., Pierret, L., Collet, D., & Philippot, P. (2008). Improvements in autobiographical memory in schizophrenia patients after a cognitive intervention. *Psychopathology, 41(6),* 388-396.

Bluck, S., & Levine, L. J. (1998). Reminiscence as autobiographical memory: a catalyst for reminiscence theory development. *Ageing & Society, 18(02),* 185-208.

Bluck, S. (2003). Autobiographical memory: Exploring its functions in everyday life. *Memory, 11(2),* 113-123

Bohlmeijer, E., Smit, F., & Cuijpers, P. (2003). Effects of reminiscence and life review on late-life depression: a meta-analysis. *International journal of geriatric psychiatry, 18(12),* 1088-1094.

Branscombe, N. R., Schmitt, M. T., & Harvey, R. D. (1999). Perceiving pervasive discrimination among African Americans: Implications for group identification and well-being. *Journal of personality and social psychology, 77(1),* 135.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3(2),* 77–101.

Brewin, C. R., Reynolds, M., & Tata, P. (1999). Autobiographical memory processes and the course of depression. *Journal of Abnormal Psychology, 108(3),* 511.

Brittlebank, A. D., Scott, J., Williams, J. M. G., & Ferrier, I. N. (1993). Autobiographical memory in depression - state or trait marker. *British Journal of Psychiatry, 162*, 118-121.

Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition, 5(1),* 73-99.

Bryant, R. A., Sutherland, K., & Guthrie, R. M. (2007). Impaired specific autobiographical memory as a risk factor for Posttraumatic stress after trauma. *Journal of Abnormal Psychology, 116(4),* 837-841.

Burianova, H., & Grady, C. L. (2007). Common and unique neural activations in autobiographical, episodic, and semantic retrieval. *Journal of Cognitive Neuroscience, 19(9),* 1520-1534.

Burns, D. (2014) *Depression and overgeneral memory in older adults : the role of executive functioning* (Unpublished doctoral dissertation) University of Glasgow, Glasgow.

Butler, R. N. (1963). The life review: an interpretation of reminiscence in old age. *Psychiatry, Journal for the Study of Inter-personal Processes, 26*: 65-76.

Cacioppo, J. T., Ernst, J. M., Burleson, M. H., McClintock, M. K., Malarkey, W. B., Hawkley, L. C., ... & Spiegel, D. (2000). Lonely traits and concomitant physiological processes: the MacArthur social neuroscience studies. *International Journal of Psychophysiology, 35(2),* 143-154.

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in cognitive sciences, 13(10),* 447-454.

Caddell, L. S., & Clare, L. (2013). How does identity relate to cognition and functional abilities in early-stage dementia? Neuropsychology, Development, and Cognition. Section B, Aging, *Neuropsychology, and Cognition, 20*, 1–21.

Carstensen, L. L. (2006). The influence of a sense of time on human development. *Science, 312,* 1913-1915

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American psychologist, 54(3),* 165.

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality & Social Psychology, 79*, 644-655.

Chiang, K. J., Lu, R. B., Chu, H., Chang, Y. C., & Chou, K. R. (2008). Evaluation of the effect of a life review group program on self-esteem and life satisfaction in the elderly. *International journal of geriatric psychiatry*, *23*(1), 7-10.

Chung, J. K., Plitman, E., Nakajima, S., Chow, T. W., Chakravarty, M. M., Caravaggio, F., . . . Mulsant, B. H. (2015). Lifetime history of depression predicts increased amyloid-β accumulation in patients with mild cognitive impairment. *Journal of Alzheimer's Disease, 45(3),* 907-919.

Cipolotti, L., & Moscovitch, M. (2005). The hippocampus and remote autobiographical memory. *The Lancet Neurology, 4(12),* 792-793.

Clare, L., Nelis, S. M., Martyr, A., Whitaker, C. J., Markova´ , I. S., Roth, I., ...Morris, R. G. (2011). Longitudinal trajectories of awareness in early-stage dementia. *Alzheimer Disease and Associated Disorders, 26,* 140–147.

Cohen (1989) Memory in the real world. Hove, UK: Lawrence Erlbaum Associates Ltd.

Coleman, P. (2005). Uses of reminiscence: Functions and benefits. *Ageing & Mental Health, 9(4),* 291–294.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological review, 107(2),* 261.

Craik, F. I., & Simon, E. (1980). Age differences in memory: The roles of attention and depth of processing. *New directions in memory and aging,* 95-112.

Craik, F. I., & Schloerscheidt, A. M. (2011). Age-related differences in recognition memory: effects of materials and context change. *Psychology and Aging, 26(3),* 671.

Craik, F. I., & Rose, N. S. (2012). Memory encoding and aging: a neurocognitive perspective. *Neuroscience & Biobehavioral Reviews, 36(7),* 1729-1739.

Crystal, H. A., Dickson, D. W., Sliwinski, M. J., Lipton, R. B., Grober, E., Marks-Nelson, H., & Antis, P. (1993). Pathological markers associated with normal aging and dementia in the elderly. *Annals of Neurology, 34(4),* 566-573.

Dalgleish, T., Tchanturia, K., Serpell, L., Hems, S., Yiend, J., de Silva, P., & Treasure, J. (2003). Self-reported parental abuse relates to autobiographical memory style in patients with eating disorders. *Emotion, 3(3*), 211.

Dalgleish, T., Williams, J. M. G., Golden, A. M. J., Perkins, N., Barrett, L. F., Barnard, P. J., . . . Watkins, E. (2007). Reduced specificity of autobiographical memory and depression: The role of executive control. *Journal of Experimental Psychology-General, 136(1),* 23-42.

Danion, J. M., Rizzo, L., & Bruant, A. (1999). Functional mechanisms underlying impaired recognition memory and conscious awareness in patients with schizophrenia. *Archives of general psychiatry, 56(7*), 639-644.

Danion, J. M., Cuervo, C., Piolino, P., Huron, C., Riutort, M., Peretti, C. S., & Eustache, F. (2005). Conscious recollection in autobiographical memory: an investigation in schizophrenia. *Consciousness and cognition, 14(3),* 535-547

Dempsey, L., Murphy, K., Cooney, A., Casey, D., O'Shea, E., Devane, D., . . . Hunter, A. (2014). Reminiscence in dementia: A concept analysis*. Dementia-International Journal of Social Research and Practice, 13(2),* 176-192.

Dennis, A. A., Astell, A., & Dritschel, B. (2012). The effects of imagery on problem-solving ability and autobiographical memory. Journal of behavior therapy and experimental psychiatry, 43, S4-S11.

Donix, M., Brons, C., Jurjanz, L., Poettrich, K., Winiecki, P., & Holthoff, V. A. (2010). Overgenerality of Autobiographical Memory in People with Amnestic Mild Cognitive Impairment and Early Alzheimer's Disease. *Archives of Clinical Neuropsychology, 25(1),* 22-27.

Dritschel, B., Beltsos, S., & McClintock, S. M. (2014). An "alternating instructions" version of the Autobiographical Memory Test for assessing autobiographical memory specificity in non-clinical populations. *Memory, 22(8),* 881-889.

D'Zurilla, T., & Nezu, A. (1980). A study of the generation-of-alternatives process in social problem-solving. *Cognitive Therapy and Research, 4*, 67–72

Edwards, D., & Middleton, D. (1986). Joint remembering: Constructing an account of shared experience through conversational discourse. *Discourse processes, 9(4),* 423-459.

El Haj, M., Antoine, P., & Kapogiannis, D. (2015). Similarity between remembering the past and imagining the future in Alzheimer's disease: Implication of episodic memory. *Neuropsychologia, 66*, 119-125.

Ellwardt, L., Aartsen, M., Deeg, D., & Steverink, N. (2013). Does loneliness mediate the relation between social support and cognitive functioning in later life? *Social Science & Medicine, 98*, 116-124.

Erikson, E.H. (1980). Identity and the life cycle. New York: WW. Norton & Company, Inc.

Eslinger, P. J., & Grattan, L. M. (1993). Frontal lobe and frontal-striatal substrates for different forms of human cognitive flexibility. *Neuropsychologia, 31(1),* 17-28.

Fargeau, M. N., Jaafari, N., Ragot, S., Houeto, J. L., Pluchon, C., & Gil, R. (2010). Alzheimer's disease and impairment of the self. *Consciousness and Cognition, 19(4),* 969-976.

Fazio, S., & Mitchell, D. B. (2009). Persistence of self in individuals with Alzheimer's disease: Evidence from language and visual recognition. *Dementia, 8,* 139–159.

Fivush, R., Bohanek, J. G., & Duke, M. (2008). The intergenerational self: Subjective perspectives and family history. In F. Sani (Ed.), Individual and collective self-continuity (pp. 131–143). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Ford, J. H., Rubin, D. C., & Giovanello, K. S. (2014). Effects of task instruction on autobiographical memory specificity in young and older adults. *Memory, 22(6)*, 722-736

Fossati, P., Hevenor, S. J., Graham, S. J., Grady, C., Keightley, M. L., Craik, F., et al. (2003). In search of the emotional self: An fMRI study using positive and negative emotional words. *American Journal of Psychiatry, 160,* 1938–1945.

Franklin, H. C., & Holding, D. H. (1977). Personal memories at different ages. *Quarterly Journal of Experimental Psychology, 29(3),* 527-532.

Gibbs, B. R., & Rude, S. S. (2004). Overgeneral autobiographical memory as depression vulnerability. *Cognitive Therapy and Research, 28(4),* 511-526.

Gidron, Y., & Alon, S. (2007). Autobiographical memory and depression in the later age: The bump is a turning point. *The International Journal of Aging and Human Development, 64(1),* 1-11.

Gilboa, A. (2004). Autobiographical and episodic memory—One and the same? Evidence from prefrontal activation in neuroimaging studies. *Neuropsychologia, 42*, 1336–1349.

Gleibs, I. H., Haslam, C., Haslam, S. A., & Jones, J. M. (2011). Water clubs in residential care: Is it the water or the club that enhances health and well-being? *Psychology & health, 26(10),* 1361-1377.

Goddard, L., Dritschel, B., & Burton, A. (1996). Role of autobiographical memory in social problem-solving and depression. *Journal of Abnormal Psychology, 105(4*), 609.

Goddard, L., Dritschel, B., & Burton, A. (1998). Gender differences in the dual-task effects on autobiographical memory retrieval during social problem solving. British Journal of Psychology, 89(4), 611-627.

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: current status and future directions. *Annual review of clinical psychology, 6*, 285-312.

Gould, O. N., & Dixon, R. A. (1993). How we spent our vacation: Collaborative storytelling by young and old adults. *Psychology and Aging,8(1),* 10.

Government Office for Science (2016)The Future of an Ageing Population https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/535187/gs-16-10-future-of-an-ageing-population.pdf

Grant, M. M., Thase, M. E., & Sweeney, J. A. (2001). Cognitive disturbance in outpatient depressed younger adults: evidence of modest impairment. *Biological psychiatry*, *50(1),* 35-43.

Greene, J. D., Hodges, J. R., & Baddeley, A. D. (1995). Autobiographical memory and executive function in early dementia of Alzheimer type. *Neuropsychologia, 33 (12),* 1647–1670.

Haight, B. K., Michel, Y., & Hendrix, S. (1998). Life review: preventing despair in newly relocated nursing home residents short-and long-term effects. *The International Journal of Aging and Human Development, 47(2),* 119-142.

Haight, B. K., Michel, Y., & Hendrix, S. (2000). The extended effects of the life review in nursing home residents. *The International Journal of Aging and Human Development*, *50*(2), 151-168.

Haight, B. K., Gibson, F., & Michel, Y. (2006). The Northern Ireland life review/life storybook project for people with dementia. *Alzheimer's & dementia: the journal of the Alzheimer's Association*, *2*(1), 56-58.

Hallion, L.S., Ruscio, A.M. (2011) A meta-analysis of the effect of cognitive bias modification on anxiety and depression. *Psychological Bulletin, 137(6),* 940- 958.

Haslam, C., Holme, A., Haslam, S. A., Iyer, A., Jetten, J., & Williams, W. H. (2008). Maintaining group memberships: Social identity predicts well-being after stroke. *Neuropsychological Rehabilitation, 18,* 671–691.

Hawkley, L. C., Burleson, M. H., Berntson, G. G., & Cacioppo, J. T. (2003). Loneliness in everyday life: cardiovascular activity, psychosocial context, and health behaviors. *Journal of personality and social psychology, 85(1),* 105.

Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., & Strosahl, K. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology, 64(6),* 1152–1168.

Heeren, A., Van Broeck, N., & Philippot, P. (2009). The effects of mindfulness on executive processes and autobiographical memory specificity. *Behaviour Research and Therapy, 47(5),* 403-409.

Helgeson, V. S. (1993). Two important distinctions in social support: Kind of support and perceived versus received1. *Journal of Applied Social Psychology, 23(10),* 825-845.

Hermans, D., Raes, F., & Eelen, P. (2005). Mood and memory. A cognitive psychology perspective on maintenance of depressed mood and vulnerability for relapse. In J. Corveleyn, P. Luyten, & S. J. Blatt (Eds.), The theory and treatment of depression: Towards a dynamic

interactionism model (pp. 43e66). Leuven, Belgium/Mahwah, NJ: Leuven University Press/Lawrence Erlbaum Associates

Hertzog, C., Kramer, A. F., Wilson, R. S., & Lindenberger, U. (2008). Enrichment effects on adult cognitive development can the functional capacity of older adults be preserved and enhanced? *Psychological science in the public interest, 9(1),* 1-65.

Hitchcock, C., Hammond, E., Rees, C., Panesar, I., Watson, P., Werner-Seidler, A., & Dalgleish, T. (2015). Memory Flexibility training (MemFlex) to reduce depressive symptomatology in individuals with major depressive disorder: study protocol for a randomised controlled trial. *Trials, 16(1),* 494.

Hitchcock, C., Mueller, V., Hammond, E., Rees, C., Werner-Seidler, A., & Dalgleish, T. (2016). The effects of autobiographical memory flexibility (MemFlex) training: An uncontrolled trial in individuals in remission from depression. *Journal of behavior therapy and experimental psychiatry*, *52*, 92-98.

Hitchcock, C., Gormley, S., Rees, C., Rodrigues, E., Gillard, J., Panesar, I., ... & Werner-Seidler, A. (2018). *The translational development of Memory Flexibility training (MemFlex) to enhance memory flexibility and reduce depressive symptomatology in individuals with Major Depressive Disorder*. Unpublished manuscript.

Holland, C. A., & Rabbitt, P. M. A. (1990). Autobiographical and text recall in the elderly - an investigation of a processing resource deficit. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 42(3),* 441-470.

Holland, A. C., & Kensinger, E. A. (2010). Emotion and autobiographical memory. *Physics of life reviews*, *7(1):* 88-131.

Holland, C. A., Ridout, N., Walford, E., & Geraghty, J. (2012). Executive function and emotional focus in autobiographical memory specificity in older adults. Memory, 20(8), 779-793.

Holland, C., Boukouvalas, A., Wallis, S., Clarkesmith, D., Cooke, R., Liddell, L., & Kay, A. (2016). Transition from community dwelling to retirement village in older adults: cognitive functioning and psychological health outcomes. *Ageing and Society*, 1-28 .

Hou, C. E., Miller, B. L., & Kramer, J. H. (2005). Patterns of autobiographical memory loss in dementia. *International journal of geriatric psychiatry, 20(9),* 809-815.

Hsieh, S., Schubert, S., Hoon, C., Mioshi, E., & Hodges, J. R. (2013). Validation of the Addenbrooke's Cognitive Examination III in frontotemporal dementia and Alzheimer's disease. *Dementia and geriatric cognitive disorders,36(3-4)*: 242-250.

Hughes, T. F., Flatt, J. D., Fu, B., Chang, C. C. H., & Ganguli, M. (2013). Engagement in social activities and progression from mild to severe cognitive impairment: the MYHAT study. *International psychogeriatrics, 25(04),* 587-595.

Hultsch, D. F., Hertzog, C., Small, B. J., & Dixon, R. A. (1999). Use it or lose it: Engaged lifestyle as a buffer of cognitive decline in aging? *Psychology and Aging, 14(2),* 245-263.

Huron, C., & Danion, J. M. (2002). Impairment of constructive memory in schizophrenia. *International Clinical Psychopharmacology, 17(3*), 127-133.

Ivanoiu, A., Cooper, J. M., Shanks, M. F., & Venneri, A. (2006). Patterns of impairment in autobiographical memory in the degenerative dementias constrain models of memory. *Neuropsychologia, 44(10),* 1936-1955.

Iyer, A., Jetten, J., & Tsivrikos, D. (2008). Torn between identities: Predictors of adjustment to identity change. In F. Sani (Ed.), Individual and collective self-continuity (pp. 187–197). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Jennings, J. M., & Jacoby, L. L. (1997). An opposition procedure for detecting age-related deficits in recollection: telling effects of repetition. *Psychology and Aging, 12(2),* 352.

Jetten, J., Haslam, C., Pugliese, C., Tonks, J., & Haslam, S. A. (2010). Declining autobiographical memory and the loss of identity: Effects on well-being. *Journal of Clinical and Experimental Neuropsychology, 32(4),* 408-416.

Josephson, B., Singer, J. A, & Salovey, P. (1996). Mood regulation and memory: Repairing sad moods with happy memories. *Cognition and Emotion, 10,* 437–444.

Karayanidis, F., Whitson, L. R., Heathcote, A., & Michie, P. T. (2011) Variability in proactive and reactive cognitive control processes across the adult lifespan. *Frontiers in psychology, 2*: 318.

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical psychology review*, *30*(7), 865-878.

Katzman, R., Terry, R., DeTeresa, R., Brown, T., Davies, P., Fuld, P., . . . Peck, A. (1988). Clinical, pathological, and neurochemical changes in dementia: a subgroup with preserved mental status and numerous neocortical plaques. *Annals of Neurology, 23(2),* 138-144.

Katz, S., Ford, A., Moskowitz, R.W., Jackson, B.A., & Jaffe, M.W. (1963). Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *Journal of the American Medical Association , 185,* 914-919.

Keating, N., & Gaudet, N. (2012). Quality of life of persons with dementia. *The Journal of Nutrition Health & Aging, 16*, 454–456.

Kempermann, G., Gast, D., & Gage, F. H. (2002). Neuroplasticity in old age: Sustained fivefold induction of hippocampal neurogenesis by long-term environmental enrichment. *Annals of Neurology, 52(2),* 135-143.

Kempermann, G., Kuhn, H. G., & Gage, F. H. (1997). More hippocampal neurons in adult mice living in an enriched environment. *Nature, 386(6624),* 493.

Kennedy, Q., Mather, M., & Carstensen, L. L. (2004). The role of motivation in the age-related positivity effect in autobiographical memory. *Psychological science, 15(3),* 208-214

Kiecolt-Glaser, J. K., Preacher, K. J., MacCallum, R. C., Atkinson, C., Malarkey, W. B., & Glaser, R. (2003). Chronic stress and age-related increases in the proinflammatory cytokine IL-6. *Proceedings of the national Academy of Sciences, 100(15),* 9090-9095.

Kitwood, T. (1990). The dialectics of dementia: With particular reference to Alzheimer's disease. *Ageing and Society, 10*, 177–196.

Kitwood, T., & Bredin, K. (1992). Towards a theory of dementia care: Personhood and well-being. *Ageing and Society, 12*, 269–287.

Kitwood, T. (1997). Dementia reconsidered: The person comes first. Buckingham, UK: Open University Press.

Kleim, B., & Ehlers, A. (2008). Reduced autobiographical memory specificity predicts depression and posttraumatic stress disorder after recent trauma. *Journal of Consulting and Clinical Psychology, 76(2),* 231.

Knopman, D. S., Parisi, J. E., Salviati, A., Floriach-Robert, M., Boeve, B. F., Ivnik, R. J., . . . Petersen, L. (2003). Neuropathology of cognitively normal elderly. *Journal of Neuropathology & Experimental Neurology, 62(11),* 1087-1095.

Knopman, D.S., Petersen, R.C. (2014) Mild cognitive impairment and mild dementia: a clinical perspective, *Mayo Clinic Proceedings, 89,* 1452–1459.

Korte, J., Bohlmeijer, E. T., Cappeliez, P., Smit, F., & Westerhof, G. J. (2012). Life review therapy for older adults with moderate depressive symptomatology: a pragmatic randomized controlled trial. *Psychological Medicine, 42(6),* 1163-1173

Kramer, A. F., Colcombe, S., Erickson, K., Belopolsky, A., McAuley, E., Cohen, N. J., ... & Wszalek, T. M. (2002). Effects of aerobic fitness training on human cortical function. *Journal of Molecular Neuroscience*, *19*(1-2), 227-231.

Kramer, A. F., Bherer, L., Colcombe, S. J., Dong, W., & Greenough, W. T. (2004). Environmental influences on cognitive and brain plasticity during aging. *Journals of Gerontology Series a-Biological Sciences and Medical Sciences, 59(9),* 940-957.

Kumfor, F., Teo, D., Miller, L., Lah, S., Mioshi, E., Hodges, J. R., ... & Irish, M. (2016). Examining the Relationship Between Autobiographical Memory Impairment and Carer Burden in Dementia Syndromes. *Journal of Alzheimer's Disease*, *51*(1), 237-248.

Kuyken, W., & Brewin, C. R. (1995). Autobiographical memory functioning in depression and reports of early abuse. *Journal of Abnormal Psychology, 104(4),* 585.

Kuyken, W., & Dalgleish, T. (1995). Autobiographical memory and depression. *British Journal of Clinical Psychology, 34(1),* 89-92.

Kwon, Y., Scheibe, S., Samanez-Larkin, G. R., Tsai, J. L., & Carstensen, L. L. (2009). Replicating the positivity effect in picture memory in Koreans: Evidence for cross-cultural generalizability. *Psychology and aging*, *24*(3), 748.

Lamers, S. M. A., Bohlmeijer, E. T., Korte, J., & Westerhof, G. J. (2015). The Efficacy of Life-Review as Online-Guided Self-help for Adults: A Randomized Trial. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences, 70(1),* 24-34.

Lashley, M. E. (1993). The painful side of reminiscence: By using the nursing process and reminiscence techniques, nurses can help the elderly come to terms with unresolved life conflicts. *Geriatric Nursing, 14(3),* 138-141.

Latorre, J. M., Ricarte, J. J., Serrano, J. P., Ros, L., Navarro, B., & Aguilar, M. J. (2013). Performance in Autobiographical Memory of Older Adults with Depression Symptoms. *Applied Cognitive Psychology, 27(2),* 167-172.

Latorre, J. M., Serrano, J. P., Ricarte, J., Bonete, B., Ros, L., & Sitges, E. (2015). Life review based on remembering specific positive events in active aging. *Journal of aging and health, 27(1),* 140-157.

Lawrence, V., Samsi, K., Banerjee, S., Morgan, C., & Murray, J. (2010). Threat to valued elements of life: The experience of dementia across three ethnic groups. *The Gerontologist, 51*, 39–50.

Lawton, M.P., & Brody, E.M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerentologist , 9*, 179-186.

Leahy, F., Ridout, N., Mushtaq, F., & Holland, C. (2017). Improving specific autobiographical memory in older adults: impacts on mood, social problem-solving, and functional limitations. *Aging, Neuropsychology, and Cognition, 1–29*.

Leahy, F., Ridout, N., & Holland, C. (2018). Memory flexibility training for autobiographical memory as an intervention for maintaining social and mental well-being in older adults. *Memory,* 1-13.

Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: dissociating episodic from semantic retrieval. *Psychology and aging*, *17*(4), 677.

Lin, Y. C., Dai, Y. T., & Hwang, S. L. (2003). The effect of reminiscence on the elderly population: a systematic review. *Public health nursing, 20(4),* 297-306.

Littrell, J. (1998). Is the reexperience of painful emotion therapeutic? *Clinical Psychology Review, 18(1),* 71-102.

Lovden, M., Ghisletta, P., & Lindenberger, U. (2005). Social participation attenuates decline in perceptual speed in old and very old age. *Psychology and Aging, 20(3),* 423-434.

Lyketsos, C. G., Lopez, O., Jones, B., Fitzpatrick, A. L., Breitner, J., & DeKosky, S. (2002). Prevalence of neuropsychiatric symptoms in dementia and mild cognitive impairment: results from the cardiovascular health study. *Jama, 288(12),* 1475-1483.

Lyons, A. D., Henry, J. D., Rendell, P. G., Corballis, M. C., & Suddendorf, T. (2014). Episodic Foresight and Aging. *Psychology and Aging, 29(4),* 873-884.

Mackinger, H. F., Loschin, G. G., & Leibetseder, M. M. (2000). Prediction of Postnatal Affective Changes by Autobiographical Memories. *European Psychologist, 5(1),* 52-61.

Madore, K. P., & Schacter, D. L. (2014). An Episodic Specificity Induction Enhances Means-End Problem-Solving in Young and Older Adults. *Psychology and Aging, 29(4),* 913-924.

Mangialasche, F., Kivipelto, M., Solomon, A., & Fratiglioni, L. (2012). Dementia prevention: current epidemiological evidence and future perspective. *Alzheimer's research & therapy*, *4*(1), 6.

Markus, H., & Nurius, P. (1986). Possible selves. *American psychologist, 41(9),* 954.

Martens, K., Onghena, P., Raes, F. (2018) *Evaluation of the effects of online Memory Specificity Training (MEST)musing a multiple baseline across participants design*. Unpublished manuscript.

Martinelli, P., Anssens, A., Sperduti, M., & Piolino, P. (2013). The Influence of Normal Aging and Alzheimer's Disease in Autobiographical Memory Highly Related to the Self. *Neuropsychology, 27(1),* 69-78.

Martinelli, P., Sperduti, M., Devauchelle, A. D., Kalenzaga, S., Gallarda, T., Lion, S., . . . Piolino, P. (2013). Age-Related Changes in the Functional Network Underlying Specific and General

Autobiographical Memory Retrieval: A Pivotal Role for the Anterior Cingulate Cortex. *Plos One, 8(12),* 11.

Masdeu, J. C., Zubieta, J. L., & Arbizu, J. (2005). Neuroimaging as a marker of the onset and progression of Alzheimer's disease. *Journal of the Neurological Sciences, 236(1),* 55-64.

Massimi, M., Berry, E., Browne, G., Smyth, G., Watson, P., & Baecker, R. M. (2008). An exploratory case study of the impact of ambient biographical displays on identity in a patient with Alzheimer's disease. *Neuropsychological Rehabilitation*, *18*(5-6), 742-765.

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in cognitive sciences*, *9*(10), 496-502.

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging, 20(4),* 554-570.

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual review of clinical psychology, 1*, 167-195.

McNally, R. J., Litz, B. T., Prassas, A., Shin, L. M., & Weathers, F. W. (1994). Emotional priming of autobiographical memory in post-traumatic stress disorder. *Cognition & Emotion, 8(4),* 351-367.

Merriam, S. B. (1993). The uses of reminiscence in older adulthood. *Educational Gerontology: An International Quarterly, 19(5),* 441-450.

Millet, S. (2011). Self and embodiment: A bio-phenomenological approach to dementia. *Dementia, 10*, 509–522.

Minnen, A., Wessel, I., Verhaak, C., & Smeenk, J. (2005). The relationship between autobiographical memory specificity and depressed mood following a stressful life event: A prospective study. British *Journal of Clinical Psychology, 44(3),* 405-415.

Mioni, G., Rendell, P. G., Henry, J. D., Cantagallo, A., & Stablum, F. (2013). An investigation of prospective memory functions in people with traumatic brain injury using Virtual Week. *Journal of Clinical and Experimental Neuropsychology*, *35*(6), 617-630.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive psychology, 41(1),* 49-100.

Moore, S. A., & Zoellner, L. A. (2007). Overgeneral autobiographical memory and traumatic events: an evaluative review. *Psychological bulletin, 133(3),* 419.

Moradi, A. R., Moshirpanahi, S., Parhon, H., Mirzaei, J., Dalgleish, T., & Jobson, L. (2014). A pilot randomized controlled trial investigating the efficacy of MEmory Specificity Training in improving symptoms of posttraumatic stress disorder. *Behaviour Research and Therapy, 56*, 68-74.

Morcom, A. M., Good, C. D., Frackowiak, R. S., & Rugg, M. D. (2003). Age effects on the neural correlates of successful memory encoding. *Brain, 126(1),* 213-229.

Moscovitch, M. (1995). Recovered consciousness: a hypothesis concerning modularity and episodic memory. *Journal of clinical and experimental neuropsychology, 17(2),* 276-290.

Murphy, K., Troyer, A. K., Levine, B., & Moscovitch, M. (2008). Episodic, but not semantic, autobiographical memory is reduced in amnestic mild cognitive impairment. *Neuropsychologia, 46(13),* 3116-3123.

Murray, L. M., & Boyd, S. (2012). Protecting personhood and achieving of life for older adults with dementia in the U.S. health care system. *Journal of Aging and Health, 21*, 350–373.

Mykletun, A., Stordal, E., & Dahl, A. A. (2001). Hospital Anxiety and Depression (HAD) scale: factor structure, item analyses and internal consistency in a large population. *The British journal of psychiatry*, *179*(6), 540-544. doi:10.1192/bjp.179.6.540

Nadel, L., & Moscovitch, M. (1997). Memory consolidation, retrograde amnesia and the hippocampal complex. *Current opinion in neurobiology, 7(2),* 217-227.

Nadel, L., & Moscovitch, M. (2001). The hippocampal complex and long-term memory revisited. T*rends in cognitive sciences, 5(6),* 228-230.

Nelson, K. (1993). The psychological and social origins of autobiographical memory. *Psychological science, 4(1),* 7-14.

Neshat Doost, H. T., Dalgleish, T., Yule, W., Kalantari, M., Ahmadi, S. J., Dyregrov, A., & Jobson, L. (2013). Enhancing Autobiographical Memory Specificity Through Cognitive Training: An Intervention for Depression Translated From Basic Science. *Clinical Psychological Science, 1(1),* 84-92.

Neugarten, B.L. (1979) Time, age, and the life cycle. *American Journal of Psychiatry, 136,* 887-894.

Neumann, A., Blairy, S., Lecompte, D., & Philippot, P. (2007). Specificity deficit in the recollection of emotional memories in schizophrenia. *Consciousness and cognition, 16(2),* 469-484.

Newsom, J. T., Nishishiba, M., Morgan, D. L., & Rook, K. S. (2003). The relative importance of three domains of positive and negative social exchanges: a longitudinal model with comparable measures. *Psychology and Aging, 18(4),* 746-754.

Nolan, M., Ryan, T., Enderby, P., & Reid, D. (2002). Toward a more inclusive vision of dementia care practice and research. *Dementia, 1*, 193–211.

Noone, P. (2015). Addenbrooke's Cognitive Examination-III. *Occupational Medicine*, *65(5),* 418-420.

Nyberg, L. (1996). Classifying human long-term memory: Evidence from converging dissociations. *European Journal of Cognitive Psychology, 8(2),* 163-184.

O'Connor, D., Phinney, A., Smith, A., Purves, B., Perry, J., Drance, E., ... Beattie, L. (2007). Personhood in dementia care: Developing a research agenda for broadening the vision. *Dementia, 6*, 121–142.

Office for National Statistics (2016) Health state life expectancies, UK: 2013 to 2015, (p.1-17) London: Office for National Statistics.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), 533-544.

Park, R. J., Goodyer, I. M., & Teasdale, J. D. (2002). Categoric overgeneral autobiographical memory in adolescents with major depressive disorder. *Psychological Medicine*, *32*(2), 267-276.

Pasupathi, M. (2003). Emotion regulation during social remembering: Differences between emotions elicited during an event and emotions elicited when talking about it. *Memory, 11(2),* 151-163.

Pennebaker, J. W., & Seagal, J. D. (1999). Forming a story: The health benefits of narrative. *Journal of clinical psychology, 55(10),* 1243-1254.

Perry, R.J., Hodges, J.R. (1999) Attention and executive deficits in Alzheimer's disease. A critical review. Brain: A journal of neurology, 122 (3): 383-404.

Petersen, R. C. (2004). Mild cognitive impairment as a diagnostic entity. *Journal of internal medicine*, *256*(3), 183-194.

Piefke, M., Weiss, P. H., Zilles, K., Markowitsch, H. J., & Fink, G. R. (2003). Differential remoteness and emotional tone modulate the neural correlates of autobiographical memory. Brain: A Journal of Neurology, 126, 650–668

Piefke, M., Weiss, P. H., Markowitsch, H. J., & Fink, G. R.(2005). Gender differences in the functional neuroanatomy of emotional episodic autobiographical memory. *Human Brain Mapping, 24*, 313–324.

Pillemer DB (1992) Remembering personal circumstances: a functional analysis. In: Winograd E, Neisser U (eds) Affect and accuracy in recall: Studies of “flashbulb” memories. Cambridge University Press, New York, pp 236–264

Pinquart, M., Duberstein, P. R., & Lyness, J. M. (2007). Effects of psychotherapy and other behavioral interventions on clinically depressed older adults: a meta-analysis. *Aging & mental health, 11(6),* 645-657.

Pinquart, M., & Forstmeier, S. (2012). Effects of reminiscence interventions on psychosocial outcomes: A meta-analysis. *Aging & mental health, 16(5),* 541-558.

Piolino, P., Desgranges, B., Benali, K., & Eustache, F. (2002). Episodic and semantic remote autobiographical memory in ageing. *Memory, 10(4),* 239-257.

Piolino, P., Coste, C., Martinelli, P., Mace, A. L., Quinette, P., Guillery-Girard, B., & Belleville, S. (2010). Reduced specificity of autobiographical memory and aging: Do the executive and feature binding functions of working memory have a role? *Neuropsychologia, 48(2),* 429-440.

Platt, J.J. & Spivack, G. (1975). Manual for the means-end problem-solving skill. Philadelphia:Hahnemans Medical College and Hospital.

Pollard, B., & Johnston, M. (2001). Problems with the sickness impact profile: a theoretically based analysis and a proposal for a new method of implementation and scoring. *Social Science & Medicine, 52(6),* 921-934.

Public Health England (2016) Recent Trends in Life Expectancy at Older Ages: Update to 2014. (p.1-29) London: Public Health England.

Raes, F., Hermans, D., Williams, J. M. G., Beyers, W., Brunfaut, E., & Eelen, P. (2006). Reduced autobiographical memory specificity and rumination in predicting the course of depression. *Journal of Abnormal Psychology, 115(4),* 699-704.

Raes, F., Hermans, D., Williams, J. M. G., & Eelen, P. (2007). A sentence completion procedure as an alternative to the Autobiographical Memory Test for assessing overgeneral memory in non-clinical populations. *Memory*, *15*(5), 495-507.

Raes, F., Williams, J. M. G., & Hermans, D. (2009). Reducing cognitive vulnerability to depression: A preliminary investigation of MEmory Specificity Training (MEST) in inpatients with depressive symptomatology. *Journal of Behavior Therapy and Experimental Psychiatry, 40(1),* 24-38.

Ramponi, C., Barnard, P., & Nimmo-Smith, I. (2004). Recollection deficits in dysphoric mood: An effect of schematic models and executive mode? *Memory, 12(5),* 655-670.

Ravaglia, G., Forti, P., Maioli, F., Martelli, M., Servadei, L., Brunetti, N., ... & Mariani, E. (2006). Conversion of mild cognitive impairment to dementia: predictive role of mild cognitive impairment subtypes and vascular risk factors. *Dementia and geriatric cognitive disorders*, *21*(1), 51-58.

Reed, A. E., Chan, L., & Mikels, J. A. (2014). Meta-analysis of the age-related positivity effect: Age differences in preferences for positive over negative information. *Psychology and Aging, 29(1)*, 1-15.

Reisberg, B. (2001). The Alzheimer's disease Activities of Daily Living International Scale (ADL-IS). *International Psychogeriatrics, 13*, 163–181.

Reisberg, B., Ferris, S., Kluger, A., Franssen, E., Wegiel, J., & de Leon, M. (2007). Mild cognitive impairment (MCI): A historical perspective. *International Psychogeriatrics, 20 (1),* 18–31.

Rendell, P. G., & Craik, F. I. (2000). Virtual week and actual week: Age-related differences in prospective memory. *Applied Cognitive Psychology*, *14*(7).

Rendell, P. G., Bailey, P. E., Henry, J. D., Phillips, L. H., Gaskin, S., & Kliegel, M. (2012). Older adults have greater difficulty imagining future rather than atemporal experiences*. Psychology and Aging, 27(4),* 1089.

Ricarte, J. J., Latorre, J. M., Ros, L., Navarro, B., Aguilar, M. J., & Serrano, J. P. (2011). Overgeneral autobiographical memory effect in older depressed adults. *Aging & Mental Health, 15(8),* 1028-1037.

Ricarte, J. J., Hernandez-Viadel, J. V., Latorre, J. M., & Ros, L. (2012). Effects of event-specific memory training on autobiographical memory retrieval and depressive symptoms in schizophrenic patients. *Journal of Behavior Therapy and Experimental Psychiatry, 43*, S12-S20.

Ricarte, J., Ros, L., Serrano, J. P., Martínez-Lorca, M., & Latorre, J. M. (2016). Age differences in rumination and autobiographical retrieval. *Aging & mental health*, *20*(10), 1063-1069.

Richards, M., & Deary, I. J. (2005). A life course approach to cognitive reserve: A model for cognitive aging and development? *Annals of Neurology, 58(4),* 617-622.

Riley, K. P., Snowdon, D. A., & Markesbery, W. R. (2002). Alzheimer's neurofibrillary pathology and the spectrum of cognitive function: findings from the Nun Study. *Annals of Neurology, 51(5),* 567-577.

Riutort, M., Cuervo, C., Danion, J. M., Peretti, C. S., & Salamé, P. (2003). Reduced levels of specific autobiographical memories in schizophrenia. *Psychiatry research, 117(1),* 35-45.

Robinson, J. A., & Swanson, K. L. (1990). Autobiographical memory: The next phase. *Applied Cognitive Psychology, 4(4),* 321-335.

Rojas, G., Leis, A., Roman, F., Allegri, R. F., & Demey, I. (2014). Detection of social cognition deficits in patients with mild cognitive impairment: toward construct validity. [Abstract] Alzheimer's & Dementia: *The Journal of the Alzheimer's Association, 10(4),* P525

Ros, L., Latorre, J. M., & Serrano, J. P. (2010). Working Memory Capacity and Overgeneral Autobiographical Memory in Young and Older Adults. *Aging Neuropsychology and Cognition, 17(1),* 89-107.

Ros, L., Latorre, J. M., Serrano, J. P., & Ricarte, J. J. (2017). Overgeneral autobiographical memory in healthy young and older adults: Differential age effects on components of the capture and rumination, functional avoidance, and impaired executive control (CaRFAX) model. *Psychology and aging*, *32*(5), 447.

Rubin, D. C., & Schulkind, M. D. (1997). Distribution of important and word-cued autobiographical memories in 20-, 35-, and 70-year-old adults. *Psychology and aging, 12*, 524-535

Rusting, C. L., & DeHart, T. (2000). Retrieving positive memories to regulate negative mood: consequences for mood-congruent memory. *Journal of personality and social psychology, 78(4),* 737.

Ryan, K. A., Weldon, A., Persad, C., Heidebrink, J .L., Barbas, N., & Giordani, B. (2012) Neuropsychiatric symptoms and executive functioning in patients with mild cognitive impairment: relationship to caregiver burden. *Dementia and Geriatric Cognitive Disorders, 34*, 206–215

Sapolsky, R. M., Krey, L. C., & McEwan, B. S. (1986). The neuroendocrinology of stress and aging: the glucocorticoid cascade hypothesis. *Endocrine reviews, 7(3),* 284-301.

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: remembering the past and imagining the future. *Philosophical Transactions of the Royal Society B: Biological Sciences, 362(1481),* 773-786.

Schacter, D. L., & Addis, D. R. (2009). On the nature of medial temporal lobe contributions to the constructive simulation of future events*. Philosophical Transactions of the Royal Society of London B: Biological Sciences, 364(1521),* 1245-1253.

Scheibe, S., & Blanchard-Fields, F. (2009). Effects of regulating emotions on cognitive performance: what is costly for young adults is not so costly for older adults. *Psychology and aging*, *24*(1), 217.

Schooler, C., Mulatu, M. S., & Oates, G. (1999). The continuing effects of substantively complex work on the intellectual functioning of older workers. *Psychology and Aging, 14(3),* 483.

Schooler, C., & Mulatu, M. S. (2001). The reciprocal effects of leisure time activities and intellectual functioning in older people: A longitudinal analysis. *Psychology and Aging, 16(3),* 466-482.

Seeher, K., Low, L. F., Reppermund, S., & Brodaty, H. (2012). Predictors and outcomes for caregivers of people with mild cognitive impairment: A systematic literature review Alzheimer's & Dementia. The Journal of the American Alzheimer's Association

Seeman, T. E., Lusignolo, T. M., Albert, M., & Berkman, L. (2001). Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. *Health psychology, 20(4),* 243.

Serrano, J. P., Latorre, J. M., Gatz, M., & Montanes, J. (2004). Life review therapy using autobiographical retrieval practice for older adults with depressive symptomatology. *Psychology and Aging, 19(2),* 272.

Sheldon, S., McAndrews, M. P., & Moscovitch, M. (2011). Episodic memory processes mediated by the medial temporal lobes contribute to open-ended problem-solving. *Neuropsychologia, 49(9*), 2439-2447.

Sheldon, S., Vandermorris, S., Al-Haj, M., Cohen, S., Winocur, G., & Moscovitch, M. (2015). Ill-defined problem-solving in amnestic mild cognitive impairment: Linking episodic memory to effective solution generation. *Neuropsychologia, 68*, 168-175.

Singer, J., Rexhaj, B., & Baddeley, J. (2007). Older, wiser, and happier? Comparing older adults' and college students' self-defining memories. *Memory, 15(8),* 886-898.

Singer, J. A., Blagov, P., Berry, M., & Oost, K. M. (2013). Self-defining memories, scripts, and the life story: Narrative identity in personality and psychotherapy. *Journal of personality, 81(6*), 569-582.

Small, B. J., Dixon, R. A., McArdle, J. J., & Grimm, K. J. (2012). Do changes in lifestyle engagement moderate cognitive decline in normal aging? Evidence from the Victoria Longitudinal Study. *Neuropsychology, 26(2),* 144.

Solomon, K. (1982). The subjective experience of the Alzheimer's patient. *Geriatric Consultant, 1*, 22–24.

Spreng, R. N., & Levine, B. (2006). The temporal distribution of past and future autobiographical events across the lifespan. *Memory & cognition, 34(8),* 1644-1651.

Staudinger, U. M. (2001). Life reflection: A social–cognitive analysis of life review. *Review of general psychology, 5(2),* 148.

Steeman, E. (2007). Living with dementia from the perspective of older people: Is it a positive story? *Aging and Mental Health, 11*, 119–130.

Stern, Y. (2002). What is cognitive reserve? Theory and research application of the reserve concept. *Journal of the International Neuropsychological Society, 8(03),* 448-460.

Suddendorf, T., & Henry, J. (2013). Proximate and ultimate perspectives on memory. *Journal of Applied Research in Memory & Cognition, 2,* 246–247.

Sumner, J. A., Griffith, J. W., & Mineka, S. (2010). Overgeneral autobiographical memory as a predictor of the course of depression: A meta-analysis. *Behaviour research and therapy*, *48*(7), 614-625.

Sumner, J. A. (2012). The mechanisms underlying overgeneral autobiographical memory: An evaluative review of evidence for the CaR-FA-X model. *Clinical Psychology Review, 32(1),* 34-48.

Sumner, J. A., Mineka, S., Adam, E. K., Craske, M. G., Vrshek-Schallhorn, S., Wolitzky-Taylor, K., et al. (2014). Testing the CaRFAX Model: Investigating the mechanisms underlying reduced autobiographical memory specificity in individuals with and without a history of depression. *Journal of Abnormal Psychology, 123*, 471-486.

Taconnat, L., Raz, N., Toczé, C., Bouazzaoui, B., Sauzeon, H., Fay, S., & Isingrini, M. (2009). Ageing and organisation strategies in free recall: The role of cognitive flexibility. *European Journal of Cognitive Psychology, 21(2-3),* 347-365.

Thorne, A., McLean, K. C., & Lawrence, A. M. (2004). When Remembering Is Not Enough: Reflecting on Self-Defining Memories in Late Adolescence. *Journal of personality, 72(3),* 513-542.

Tilvis, R. S., Kähönen-Väre, M. H., Jolkkonen, J., Valvanne, J., Pitkala, K. H., & Strandberg, T. E. (2004). Predictors of cognitive decline and mortality of aged people over a 10-year period. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 59(3),* M268-M274.

Towse J N, & Neil D. (1998) Analyzing human random generation behavior: A review of methods used and a computer program for describing performance*. Behavior Research Methods, Instruments & Computers, 30:* 583-591.

Tulving, E. (1995). Organization of memory: Quovadis? In M.S. Gazzaniga (Ed.), The cognitive neurosciences (pp. 839–847). Cambridge, MA: MIT Press.

Valenzuela, M., Brodaty, H., Wen, W., Chen, X., & Sachdev, P. (2009). Lifespan mental activity predicts diminished rate of hippocampal atrophy. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association,* 5(5), e9.

Vandermorris, S., Sheldon, S., Winocur, G., & Moscovitch, M. (2013). Differential contributions of executive and episodic memory functions to problem-solving in younger and older adults. [; Research Support, Non-U.S. Gov't]. *Journal of the International Neuropsychological Society : JINS, 19(10),* 1087-1096.

Wang, H. X., Jin, Y. L., Hendrie, H. C., Liang, C. K., Yang, L. L., Cheng, Y. B., . . . Gao, S. J. (2013). Late Life Leisure Activities and Risk of Cognitive Decline*. Journals of Gerontology Series a-Biological Sciences and Medical Sciences, 68(2*), 205-213.

Watkins, E., Teasdale, J., & Williams, R. (2000). Decentring and distraction reduce overgeneral autobiographical memory in depression. *Psychological medicine, 30(04),* 911-920.

Watkins, E., & Teasdale, J. D. (2001). Rumination and overgeneral memory in depression: effects of self-focus and analytic thinking. *Journal of Abnormal Psychology, 110(2),* 353.

Watkins, E., & Teasdale, J. D. (2004). Adaptive and maladaptive self-focus in depression. *Journal of affective disorders, 82(1),* 1-8.

Watkins, E. R., Baeyens, C. B., & Read, R. (2009). Concreteness training reduces dysphoria: proof-of-principle for repeated cognitive bias modification in depression. *Journal of abnormal psychology, 118(1),* 55.

Watkins, E. R., Taylor, R. S., Byng, R., Baeyens, C., Read, R., Pearson, K., & Watson, L. (2012). Guided self-help concreteness training as an intervention for major depression in primary care: A phase II randomized controlled trial. *Psychological medicine, 42(07),* 1359-1371.

Webster, J. D., Bohlmeijer, E. T., & Westerhof, G. J. (2010). Mapping the future of reminiscence: A conceptual guide for research and practice*. Research on Aging, 32(4),* 527-564.

Wechsler, D. (1997). *Wechsler memory scale (WMS-III)* (Vol. 14). San Antonio, TX: Psychological corporation.

Wechsler, D. (2009). Wechsler Memory Scale–Fourth Edition (WMS–IV) technical and interpretive manual. San Antonio, TX: Pearson.

Wessel, I., Meeren, M., Peeters, F., Arntz, A., & Merckelbach, H. (2001). Correlates of autobiographical memory specificity: The role of depression, anxiety and childhood trauma. *Behaviour Research and Therapy, 39(4),* 409-421.

Westerhof, G. J., Bohlmeijer, E., & Webster, J. D. (2010). Reminiscence and mental health: A review of recent progress in theory, research and interventions. *Ageing and Society, 30(04*), 697-721

Westerhof, G. J., & Bohlmeijer, E. T. (2014). Celebrating fifty years of research and applications in reminiscence and life review: State of the art and new directions. *Journal of Aging Studies, 29,* 107-114.

Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: the frontal lobes and autonoetic consciousness. *Psychological bulletin, 121(3*), 331.

Wheeler, M. E., & Buckner, R. L. (2004). Functional–anatomic correlates of remembering and knowing. *Neuroimage, 21,* 1337–1349.

Williams, J. M. G., & Broadbent, K. (1986). Autobiographical memory in suicide attempters. *Journal of Abnormal Psychology, 95(2),* 144-149.

Williams, J. M. G., & Scott, J. (1988). Autobiographical memory in depression. *Psychological medicine*, *18*(3), 689-695.

Williams, J. M. G., Ellis, N. C., Tyers, C., Healy, H., Rose, G., & MacLeod, A. K. (1996). The specificity of autobiographical memory and imageability of the future. *Memory and Cognition, 24(1),* 116-125.

Williams, J. M. G., Stiles, W. B., & Shapiro, D. A. (1999). Cognitive mechanisms in the avoidance of painful and dangerous thoughts: Elaborating the assimilation model. *Cognitive Therapy and Research, 23(3),* 285-306.

Williams, J. M. G., Teasdale, J. D., Segal, Z. V., & Soulsby, J. (2000). Mindfulness-based cognitive therapy reduces overgeneral autobiographical memory in formerly depressed patients. *Journal of Abnormal Psychology, 109,* 150–155.

Williams, J. M. G. (2006). Ca pture and r umination, f unctional a voidance, and ex ecutive control (CaRFAX): three processes that underlie overgeneral memory. *Cognition and Emotion*, *20*(3-4), 548-568.

Williams, J. M. G., Barnhofer, T., Crane, C., Herman, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological bulletin, 133(1),* 122.

Wilson, R., Scherr, P., Schneider, J., Tang, Y., & Bennett, D. (2007). Relation of cognitive activity to risk of developing Alzheimer disease. *Neurology, 69(20),* 1911-1920.

Wong, P. T., & Watt, L. M. (1991). What types of reminiscence are associated with successful aging? *Psychology and Aging, 6(2)*, 272

Zigmond, A.S., & Snaith, R.P. (1983) The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica, 67*: 361-370.

List of appendices

Appendix 1. Means End Problem-Solving procedure (MEPS) scenarios for Chapters 2 and 3

Relationships
You love your partner very much, but you have many arguments. One day they leave you. You want things to be better. The story ends with everything being fine between you and your partner. You begin the story with your partner leaving you after an argument.

Neighbours
You have just moved in that day and don't know anyone. You want to have friends in the neighbourhood. The story ends with you having many good friends and feeling at home in the neighbourhood. You begin the story with you in your living room immediately after arriving in the neighbourhood.

Friends
You notice that your friends seem to be avoiding you. You want to have friends and be liked. The story ends with your friends liking you again. You begin the story where you first notice your friends avoiding you.

Work
You are having trouble getting along with your boss on your job. You are very unhappy about this. The story ends with your boss liking you. You begin the story where you are not getting along with your boss.

Appendix 2. Means End Problem-Solving procedure (MEPS) scenarios for Chapter 4 study

Set A:

1) You love your son/ daughter very much and want to help as they have just had a new baby. You begin to feel as though you are interfering and they don't seem to appreciate your help. The story ends with everything being fine and your relationship with your son/ daughter is back to normal. You begin the story when you start to feel unappreciated.

2) This year, your schedule is quite light and you would love to learn how to paint in an evening art class. However, you are very insecure and if you think about your first painting class, you start to get warm and your hands start to sweat. The story ends with you looking forward to your next art class. You begin the story when you feel afraid about going to the first class.

3) You have started to notice that one of your friends seem to be avoiding you. You become worried and fear you have done something terrible. The story ends with you and your friend getting along fine again. You begin the story where you first notice your friend is avoiding you.

4) You are having trouble getting along with your boss on your job. You feel the tension mounting between yourself and your boss and you are very unhappy about this. The story ends with everything being fine and the issues between you and your boss have been resolved. You begin the story where you are not getting along with your boss.

Set B:

1) You love you partner very much and have been in a happy relationship for many years, but you begin to have arguments regularly. One day they leave you. You want things to be better. The story ends with everything being fine and the issues within your relationship have been resolved. You begin the story with your partner leaving you after an argument.

2) You have always been a good driver but do not feel confident driving anymore and your family want you to give it up. You are worried about this as you have no other way of getting to your social club meetings other than to drive. The story ends with everything being fine and you manage to get to your meetings. You begin the story with you starting to feel less confident driving.

3) Two of your closest friends have fallen out with each other. You feel uncomfortable being stuck in the middle and don't want to lose your friendship with either of them. The story ends with everything being fine and you no longer feel uncomfortable. You begin the story with your two friends falling out.

4) You are working on an important team project. Members of the group keep giving you complicated, time consuming tasks to do. This makes you very frustrated with them. You feel the tension mounting and you find it increasingly difficult to remain calm when you talk to them. The story ends when the situation with your colleagues has improved. Start the story the moment you become angry/frustrated with your colleagues.

Set C:

1) You go shopping with your daughter regularly and enjoy spending this time with her. Recently you have started feeling very tired during your shopping trips but don't want to admit this to your daughter. The story ends with everything being fine and you still enjoy spending time regularly with your daughter. You begin the story when you begin to feel tired.

2) You have just moved into a new neighbourhood and don't know anyone. You want to meet people and be a part of the community in the new neighbourhood. The story ends with you having many good friends and feeling at home in the neighbourhood. You begin the story immediately after arriving in the neighbourhood.

3) Your best friend has recently found a new partner and your friend has been spending less and less time with you. To make matters worse, you have discovered that you and the new partner do not get along. You start to wonder if you are losing your best friend. The story ends with you and your friend maintaining a supportive relationship. You begin the story when you feel sad about the situation with your friend.

4) You helped a lady from your social club once with her shopping and now she keeps asking you to help her with various other chores. You begin to feel uncomfortable because you want to be helpful but cannot commit to helping her all the time as you have other responsibilities with your own family. The story ends with everything being fine again. You begin the story with the lady asking you for help again, causing you to feel uncomfortable.

Appendix 3. Participant feedback form questions from Chapters 2 and 3

1. Did you enjoy the programme overall?

2. How satisfied were you with the delivery of the training programme?

3. Did you feel the amount of activities you were asked to do was reasonable?

4. Were there any aspects of the programme or activities you found particularly enjoyable?

5. Were there any aspects of the programme or activities you found particularly difficult?

6. How well did you feel you understood the purpose of the training programme?

7. Did you feel you benefitted in any way from taking part in the training programme, and if so, how?

Any other comments or suggestions for improvement of the programme:

Appendix 4. AMT cue words for Chapters 2 and 3:

Pre-intervention:

Irritated

Reliable

Gloomy

Upbeat

Rude

Proud

Unlucky

Interested

Lazy

Confident

Post-intervention:

Alert

Scared

Pleasurable

Angry

Courage

Hurt

Calm

Awful

Bold

Anxious

3-month follow up:

Delightful

Tense

Bright

Sorry

Carefree

Mistake

Lively

Fault

Reassured

Clumsy

Appendix 5. AMT cue words for Chapter 4 (counterbalanced across time):

Set A:

Frustrated

Relaxed

Disappointed

Passionate

Clumsy

Hopeful

Afraid

Interested

Embarrassed

Funny

Set B:

Angry

Calm

Clumsy

Determined

Bored

Cheerful

Scared

Successful

Confused

Impressed

Set C:

Irritated

Peaceful

Sad

Enthusiastic

Lazy

Happy

Nervous

Safe

Unsuccessful

Proud

Appendix 6. Interview schedule

Opening questions

1.Introduction:

I'd like to start by asking, what was your first impression of the life review programme?

PROMPT: did you find it useful? / If not, why?

What your reasons for taking part?

Did you have any worries or concerns about taking part?

PROMPT: what were they? Do you feel they've been resolved?

Transition questions

2.Opinions:

Did you enjoy the programme overall?

PROMPTS: What parts did you enjoy most and why? / What parts didn't you enjoy?

Key questions

2.Effectiveness:

Did you feel practicing recalling memories from the past has helped you in any way?

Did recalling memories affect you emotionally?

Prompt: How did recalling emotional positive memories affect you?

Did recalling memories from your past influence your relationships? E.g. the way you feel about people close to you?

Do you think you will continue recalling memories from the past now that the programme has finished?

If yes, why?

Has it made you aware of anything you hadn't thought about before?

Can you tell me a bit about how you feel about your memory now?

Has the programme had on how you feel about your life now?

Prompt: How well would you say you are satisfied with your life?

3.Feasibility:

How did you find the structure of the programme?

Was 4 sessions over 4weeks enough, could you have done more or preferred to do less?

Were the materials helpful?

Acceptability:

Were the activities you had to complete too hard/too easy?

Would you recommend the programme to another person with mild memory problems?

Did you dislike any aspects of the programme?

Prompt: Were there any parts you would not want to do again?

Were there any parts of the programme that you particularly liked that you would enjoy doing again?

Closing questions:

5. Recommendations for improvement:

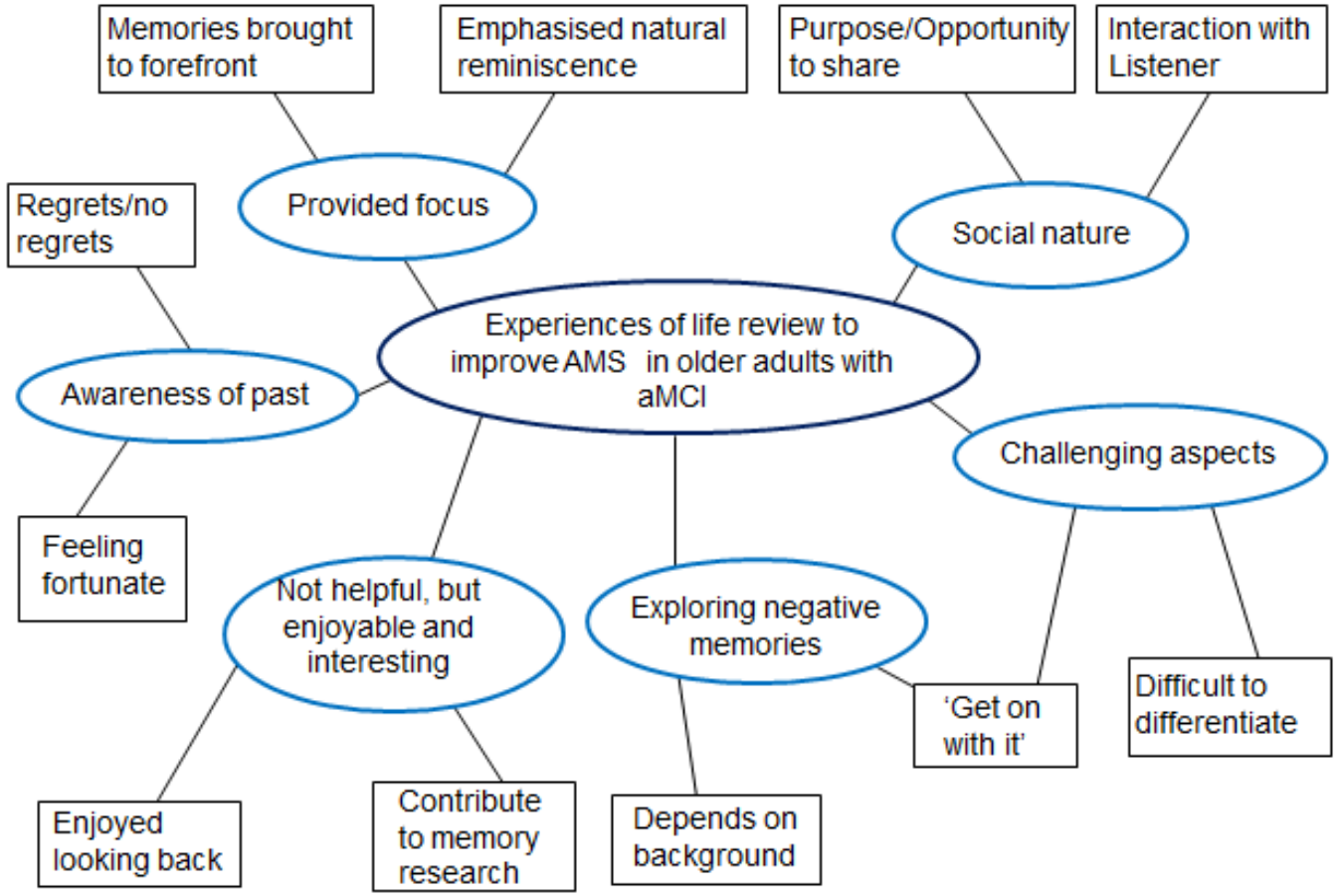
Do you think this programme could be improved? If so, how?

Prompt: Would you add/remove anything? Would you change anything about the programme?

Do you feel it was worthwhile taking part in the programme overall? (Considering both positive and negative experiences)

Is there anything else you would like to comment on?

Appendix 7. Thematic map



Appendix 8. Additional quotation examples which relate to themes in transcripts

Theme 1: Provided focus

> “I think the main thing is, you’ve instructed us, or me, to focus on good things rather than bad things”

> “I suppose one can improve that by practice really yes, and sort of concentrating on a place, a time and a place, rather than a general feeling”

> “Yes for somebody that’s got something like I’ve got, which is mild cognitive impairment, for somebody that’s got that this is ideal. I think this is good because if you’ve got certain things that you cannot remember at the time but getting something to do like this, it makes you think back and get your brain to try and work it properly.”

> “It’s probably something we all do, we don’t really look back, and it’s passing in your head but you don’t, well I don’t really think about it.”

> “Well I’ve recalled things that I felt “Oh I’d forgotten about that”. But you know that had been tucked away”

Theme 2: Social nature

> “Oh yeah it’s been very enjoyable, yeah. Yeah it doesn’t happen normally in life that you’re talking to somebody that asks you questions about your past in the way you’ve been doing so it’s been really interesting.”

> “Yeah it’s good actually, it’s nice because it’s brought things back to me which I probably had forgotten about, and nobody else would probably ask.”

"As a person, to actually sit down and think, where I haven't been giving myself time to do that I've been doing other things instead…rather than spending 99% of the time on everybody else, which I do anyway, that's my normal life.."

Theme 3: Challenging aspects

"I think it was easier to remember things recently but then in a way, you think it was sort of a boring life nothing really exciting life but it was easier to remember sort of that than prior to that because I couldn't pin it down to any particular time…"

"Yeah very difficult, the specificality of it is very difficult, you know the general memories are easy, but when you ask exactly where and when…"

"I think when my mind gets into the memory focussing made, and the difficulty then is, in the middle I, you know the 14, is remembering when things fitted in. So you know things come when you ask the questions, I get a memory which is out of sequence."

Theme 4: Exploring negative memories

"…other people might have a lot of memories they don't want to remember again, but erm no I've enjoyed it and I'd recommend it."

"…perhaps the bad things you let go anyway"

"I don't think erm there's any particular period that I look back with horror sort of thing, but I suppose if you had, erm, I'm sure my daughter Jane would do, she's had a not a very good life, but sometimes maybe, just looking back on that you may even think ok well it happened sort of thing and erm, I've shelved that now and I'm ok, I can talk about it without getting upset, so I don't know… I think maybe again because if I had had a bad childhood, if I had had lots of bad experiences I probably wouldn't have gone into it."

“I was talking to my husband about it…but I don’t know if he would get any, erm, understanding to benefit from it, because his childhood wasn’t a very good one”.

“Although I know it was very emotional at times, If think if I'm gonna help somebody else then I'm prepared to do it, and I'm quite happy doing it.”

“I mean you know it was really tragic at the time but erm, and you know, it was bad the first few years because you think about it all the time. But I just told myself there’s nothing you can do about it you, there’s just nothing you can do about it you ow, you’ve just got to move on.”

“Its erm, I mean, what is a bad memory? It is as I said I erm, I dealt with the explosion of the grand hotel Brighton and… but again, the job that we do, and I won’t say that’s every day of the week but I’ve never had a nightmare about it and er you just you know as a police officer you come across people stabbed or a road accident and you just get on with it you do the job that you've gotta do.”

“Yeah because you just didn't I mean you just didn't know you could hear the bombs dropping all round and you got used to it. I mean it sounds awful but you just took no notice of it in the end… but it was quite funny when you look back on it, you didn’t worry in the end, you know you got to the stage well if it's gonna happen it’s gonna happen.”

Theme 5: Not helpful, but enjoyable and interesting

“I just hope that it’s, you know, that it does prove to be helpful for people.”

“I don’t mind doing it because I know that probably it will help somebody else who’s worse off than me and that’s what I look at.”

“…it has been a very enjoyable experience”

“ erm, was surprised how enjoyable it was.”

Theme 6: Awareness of past

“…but I’ve had such a good life”

“…no I quite enjoyed doing it…As I said before I’m very grateful I was born when I was. I mean I think, I think, looking back, it’s been amazing really”

“So I am, you know, as I say I’m very fortunate”

“I enjoyed doing the that homework actually because it made me think about what I have done in the past as well”

Appendix 9. Example of sustained attention task in control group workbook (Chapter 4)